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THE CLIMATIC TREATMENT OF CHILDREN

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BY

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PREFACE

The present work is intended to fill a vacant place in medical literature. While a good deal has been written on the climatic treatment of adults, most of it is somewhat one-sided, referring too exclusively to the management of tuberculosis. The climatotherapy of early life has been rather neglected; it differs widely, often radically, from that of older persons, but we have nothing important or comprehensive in the English language, or bearing on American practice, concerning this division of the subject.

Treatises on medical climatology are apt to deal too largely in generalities, whereas the practitioner is called upon to prescribe a change of air with some precision. I have therefore, in the description of climates, gone into very minute detail, especially in regard to this continent. The chapter on the climatology of temperate North America is the first attempt to present, in accessible form, a large mass of material hitherto lying buried in government reports. Somewhat fewer details are given in regard to foreign climates, on which good monographs have been published in England; they are, nevertheless, not neglected on the following pages.

No work on climatotherapy can be really satisfactory, unless it partakes of the features of a ready reference manual. For this reason, I have appended a very complete index, extending to individual localities, so

that the reader may inform himself as to climatic minutiæ with the smallest possible loss of time. A manual of this sort will be a useful supplement to the ordinary treatise on therapeutics, which rarely embraces more than generalized climatic recommendations.

Finally, the urgent need, in this country, of better provision for the children of the poorer classes will be touched upon. This point of view has been forced upon me in the course of preparing this volume; America has lagged very far behind Europe in this regard, and even now our awakening is but slow and unsatisfactory. Possibly this book may act as a stimulus in this very important direction; the feasibility of adequate climatic treatment of children rests largely on economic factors, to the bearings of which communal workers, as well as physicians, should rouse themselves with more energy than they have so far displayed.

THE AUTHOR.

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(For practical reasons, it has seemed best to give temperatures in Fahrenheit degrees, and elevations in feet, in preference to employing the centigrade scale and metric system).

THE CLIMATIC TREATMENT OF CHILDREN

CHAPTER I

GENERAL PRINCIPLES

The practice of medicine, as distinct from surgery, employs two therapeutic methods which we may designate as chemical and physical; the former consists in the administration of drugs and the like, the latter in the application of the great natural forces. The conditions of the atmosphere, called meteorological, supply these forces in an almost infinite variety of combination, and in a most conveniently applicable form; climatic treatment therefore constitutes probably the most generally useful department of physical therapeutics, and as such merits a more thorough and detailed study than it has hitherto obtained.

We most easily appreciate the value of climatic therapy when we recall that our other physical measures, namely baths, massage, electricity, and the newer photo- and radiotherapy, generally apply but one agent at a time. Climatic treatment not only comprises the application of heat and cold, though this forms its greatest and most important part; it also employs the atmospheric pressure, sunlight, a species of massage by the winds, and the atmospheric moisture. We therefore

have no difficulty in recognizing that its action may often be superior to that of any one physical agent, but we also see that careful study and good judgment are requisite, if we wish to present the various climatic elements in the combination most suitable to the particular individual who comes to us for relief. We must therefore introduce our subject with a statement of its general principles and an outline of its main spheres of usefulness.

In acute disease, we do not often resort to climatic treatment; here its main value is prophylactic, and in this direction we may often achieve admirable, though not always demonstrable results. This end is practically accomplished by choosing a healthful climate for the permanent residence of the normal or nearly normal individual. In chronic disease, on the other hand, the judicious selection of climate is one of our most valuable resources, and an efficient adjunct to medication and the other physical remedies. Both of these aspects of the subject shall receive extended discussion as we proceed.

Special attention attaches to the climatotherapy of childhood. The young subject is far more responsive to his physical environment than the adult; he not only requires the maintenance of health for the time being, but demands, in addition, surroundings favorable to his normal progressive growth and development. On account of his relatively very active metabolism, he also affords better opportunities for checking the advance and repairing the ravages of various ailments. Thus the proper application of physical measures may be expected to yield particularly good results in infants and children, and among these measures the selection of a beneficial climate takes a high rank.

The cardinal principles of climatic therapeutics are those so aptly laid down by Hoffmann[1] for indirect therapeutics in general, namely training and rest, expressed by him somewhat better in the German terms *Uebung* and *Schonung*. Training (*Uebung*) is called for under such circumstances as the following. An organ, or the entire organism, may never have learned to perform a full, normal quantum of work; it may have all along either managed to shirk a certain proportion of its duties, or shown an abnormal tendency to break down under a moderate strain. In such a case, it falls to the physician gradually to train and educate the inadequately developed organ or body, not to stimulate it, as is so often done, with strychnin and the like. It would be regarded as most unintelligent to force a boy to do a man's physical work; yet, presumably competent practitioners are attempting a parallel to this every day, with their sub-normal patients as subjects, and too often as victims.

The above aptly illustrates the difficulty involved in raising the subnormal adult to par; training often fails in later life, even though it may not always entail the potential harm of overstimulation. In the child we are dealing with a somewhat different proposition; the growth of its body is still incomplete, its later years may be managed so as to yield better results, some of the lost ground may yet be recovered. We are therefore justified in dwelling at some length on the physical, particularly the climatic, therapeutics of the approximately normal child, in addition to discussing the treatment of actually sick children.

[1] Vorlesungen über allgemeine Therapie, Leipzig, 1888.

A seriously diseased organ or organism requires rest; not always absolute rest, which is indeed usually unobtainable, but relative rest, what the Germans call *Schonung*, secured by a scaling down of the normal quota of work, either by enforced inactivity, or by shifting functions into vicarious channels. This indication is usually met more successfully than that of training, but not because of greater medical skill and resources. We shall have occasion to observe, as we go on, that most of the superiority of rest-cures, in the broad sense, over courses of training, so far as achieving tangible results is concerned, is due to a combination of circumstances. This peculiarity attaches to climatic treatment in an eminent degree, and we shall avoid unnecessary digression by investigating it from this standpoint alone; a brief survey of a few climatic, anthropological and physiological facts will make this matter perfectly clear.

The Physiology of Climate. The distinction between climate and weather cannot be stated better than in Hann's introductory words: "By climate we comprehend the total of the meteorological phenomena that characterize the average state of the atmosphere at any one locality on the earth's surface. What we call weather is merely a phase, a single act, of the succession of phenomena, whose perennially more or less similar course constitutes the climate of a locality." Physiologically, we cannot maintain this distinction, for the human body must provide not only for average, but also for occasional and even exceptional meteorological conditions. Thus, medical climatology includes both climatology and meteorology within its scope, and is not

an exclusive application of the former alone; it is only the mathematical accuracy of the former science, as opposed to the numerous uncertainties still obscuring the latter, that have given the branch of medical science here under discussion its present trend and consequent appellation.

Few creatures are capable of so widespread an acclimatization as is man; yet, in spite of his range over almost the entire globe, he too, like all other animals, thrives better under some conditions than others, as is readily proved by a few statistical data. The average temperature of the earth's surface is 55 degrees, or thereabout; a careful survey of the various inhabited countries shows that the majority of the human species dwell in regions warmer than this, and that the countries averaging below 32 degrees are very sparsely settled. Historical research shows that, previous to the nineteenth century, the disproportion was several times as great as now; the cooler temperate zones have only begun to be filled up within a century or two, and it is not difficult to prove that the recent change is chiefly due to modern industrialism. None of the colder countries can feed their population with their own products alone, save in such recently opened districts as our own Northwest, where the density of the population as yet rarely approaches twenty to the square mile.

Man evidently is at least as well adapted to warm as to cool climates, even with his present constitution, which is altogether acquired; he does not do very well in climates where frost is the rule. Anthropological studies, however, go far beyond this; the hairless skin of man, as well as recent investigations as to his origin,

point to the tropical regions as his aboriginal home; they are the sole abode of the anthropoid primates, as well as of nearly all the evidently primitive human tribes (pygmies, negritos). It would therefore appear that our aboriginal environment is that of a very warm and humid climate, and that only a minority of our species have become habituated to cool regions by a very gradual process of acclimatization, aided by the invention of protective clothing. Now it happens that nearly all medical research has emanated from this minority, and that the human pathology best known is that of a cool climate; indeed, until recently, most of our ailments were attributed to the vicissitudes of that climate, and this opinion probably contains more than a grain of truth. It is therefore not strange that removal to a more genial zone should always have been regarded as a most valuable remedy for disease.

We thus see why the first attempts at climatotherapy were based on the principle of sparing the diseased organism the shocks unavoidable in a harsh climate; until quite recently this phase alone was studied, hence the somewhat one-sided development of our science. The sparing indication is met all too easily, but the indication for training, with the avoidance of injury, is satisfied with far more difficulty, and has hitherto been handled rather empirically. As a consequence, the results, especially in children, have been rarely brilliant and often disastrous, although a rational method can undoubtedly be worked out with the aid of even such data as are already at hand; what we need most of all is to keep in close touch with our physiological standards, and to set out with a clear understanding of the effect

of the various climates on the normal subject. We may therefore begin with a brief review of the physiological relations of the atmospheric phenomena.

Temperature. The nude body of a healthy adult, when at rest, maintains its normal warmth of 99 degrees most easily at an air temperature of about 80; this may be called the indifferent temperature, and is reduced by very light summer clothing to about 75, by heavy winter dress to about 65 degrees; under these circumstances we feel just comfortable, when lying down or otherwise inactive. At lower temperatures we are obliged to furnish an additional amount of body heat; this we accomplish by means of an accelerated oxidation of our tissues, in its turn requiring an increased supply of oxygen through augmented respiratory activity. We achieve this extra oxidation most readily by means of muscular exertion; moderate muscular exercise, such as walking at a steady gait, lowers the indifferent temperature about ten degrees more. We can indeed effect a still further reduction by violent exercise, but this is so rapidly limited by muscular exhaustion that it is available only for a brief space of time. We therefore require artificial heat in our rooms whenever their temperature falls much below 65 degrees; out of doors, when we move about freely, we can dispense with extra wraps and overcoats at a lower temperature, down to about 55. Exposure to the direct rays of the sun introduces a factor so variable as to preclude any reduction to figures; it must suffice to state that a leeway of an indefinite, but often considerable, number of degrees is thereby afforded, depending chiefly upon the clearness of the sky. Under favorable conditions a sunny and

sheltered spot will feel comfortably warm at shade temperatures near the freezing-point.

In water, an excellent conductor of heat compared to the air, the indifferent temperature is very much higher, 90 to 92 degrees in adults, 95 in young children, and 98 in early infancy. These data are entered here, in order to dispose of this subject at once; besides, as we shall see, bathing is often made to form part of a course of climatic treatment.

The resting or sparing indication is therefore fulfilled adequately in a climate affording a daylight temperature of between 65 and 75 degrees, corresponding to an average temperature considerably lower, for the night temperatures concern us relatively little so long as they are not uncomfortably high and interfere with sleep. A lower day temperature is restful only if exercise can be indulged in, therefore neither in extreme invalidism nor when walking is impossible for other reasons. At day temperatures below 55 degrees, the element of training supplants that of rest, and whenever the latter alone is desired, so cool a climate is contraindicated. We can easily see that, near this thermal border line, it is possible to introduce some very delicate gradations with regard to the relative adjustment of temperature, rest, and exercise. On the one hand, the efficiency of the locomotor apparatus may be the chief consideration; on the other, the adequacy of the respiratory, circulatory, and excretory organs may weigh more heavily. We also see how precise but delicate a therapeutic measure climatic treatment becomes so soon as we have to employ it in meeting the indication of training, and how simple its application is when rest is the sole desideratum.

The generally superior efficacy of rest-cures, in actual practice, is readily understood from the above discussion; it is almost entirely due to the ease and certainty of their application. It is also clear, however, that we can do excellent work, with skillful management, in cases where training is the object in view. The whole secret lies in the careful adjustment to the patient of temperatures below the indifferent point, and we shall have ample occasion to return to this subject when, in the following chapters on applied climatotherapy, we refer, again and again, to the therapeutic procedure commonly called "hardening," the most important and most abused of climatic measures.

When the temperature of the air exceeds 75 degrees, the body, even though at rest and lightly clothed, produces more heat than is needed for the maintenance of its normal warmth. The disposal of its surplus heat is effected, in the first instance, by radiation, which is, however, at best, limited to a moderate amount and greatly interfered with by even a minimum of clothing. The final resort of the human organism to meet the stated condition is the production and evaporation of sweat, which is very effective under favorable circumstances. The mere production of sweat, however, calls for additional work on the part of the vasomotor apparatus, and especially an accelerated action of the heart; heat is therefore altogether a stimulant, a point frequently disregarded in therapeutics. Many practitioners consider very warm climates as generally sedative, but the confusion with the merely mild climates is obvious, the distinction involves more than a little difference. In the present discussion we have set the border line at

about 75 degrees; even this is, as we have seen, somewhat too high to be truly sedative whenever any amount of physical exertion is desirable; in subjects calling for the last, a lower level of temperature is quite essential to meet the indication of rest.

Humidity. The matter does not rest with the mere secretion of sweat; its rapid and complete evaporation from the surface of the body is really the chief point. In this connection an entirely new factor comes into play, namely, the relative humidity of the surrounding air. Approximate saturation of the atmosphere with aqueous vapor totally bars evaporation, which becomes more and more effective as the proportion of moisture, the relative humidity of the air, falls below the point of saturation, 100 per cent.

Inasmuch as the atmospheric humidity affects us chiefly as regards the evaporation of cutaneous moisture, it is evident that our perception of this meteorological factor is indistinct at low temperatures, becoming well defined only above the indifferent point, about 55 degrees; below this, our impressions of the atmospheric humidity are quite apt to be fallacious. We are often told, for example, that the winter weather in New York City is damp during the cold spells; as a matter of fact, the relative humidity ranges from 60 down to 40 per cent. and less on these occasions. We are also informed that the intense cold in the Adirondack Mountains is "dry." The truth is that the mean relative humidity is lower in winter in the seaboard region about New York City than anywhere else in the state, and it is likewise true that the traditional "dry cold" of Minnesota and Iowa is also five per cent. moister than that of the Middle Atlantic

coast. So much for popular impressions on this subject; the fact remains that the proportion of moisture at low temperatures is practically imperceptible and immaterial, as the transpiration through the skin is, in any case, insignificant in cold weather compared to its vast importance in summer.

From 55 degrees upward, on the other hand, the effects of moist, as contrasted with dry air, become increasingly perceptible, growing dominant when the atmospheric temperature rises into the seventies. At very high temperatures, indeed, dryness becomes absolutely essential to the mere maintenance of life. A temperature near that of the body, with the air almost saturated with moisture, will, in a very short time, cause fatal hyperpyrexia, so-called "heat-stroke," or "sunstroke," as the result of the accumulation of body heat which is continually produced without the possibility of elimination. The frequent fatalities due to the combination of high temperature and humidity are sufficiently familiar; the danger line lies very near the point indicated by the preceding discussion; namely, at 75 degrees with 100 per cent. of moisture, equivalent to 80 degrees with 80 per cent., 90 degrees with 50 per cent., and 100 degrees with 30 per cent.; all these combinations are quite frequent in many parts of our continent, during the warmer months. We see, furthermore, that very intense heat may be endurable and quite safe, provided the air be dry; in our semi-arid districts, a temperature of 100 degrees is often associated with only 10 per cent. of humidity; this is equivalent to saturated air at only 70 degrees, and therefore relatively harmless if violent exertion and exposure to the far hotter direct rays of

the sun be avoided. Heat-stroke is infinitely commoner in our humid East than in the far drier though often hotter West.

The sensation produced by the approach to the danger line is called sultriness; since the normal person leads a more or less active life, this unpleasant condition becomes perceptible in a saturated atmosphere no warmer than 65 degrees. This is the average temperature of the wet-bulb thermometer at New York in mid-June and early September, and between those dates this climate is notoriously sultry and unwholesome. It is interesting to note the agreement on this subject between the popular impression and the scientific data.

The last paragraphs abundantly illustrate the fallacy involved in the common belief that the very warm climates are restful. The unremitting stimulation of the vasomotor apparatus, that attends even a short residence in such a region, has by no means a hardening effect; on the contrary, the main result achieved is vasomotor exhaustion, a part of the general systemic condition called enervation, the patient returning home enfeebled and less resistant than before. This is shown most conspicuously in an extreme sensitiveness to moderate changes of temperature; a fall of ten o fifteen degrees, which we should barely notice, may entail serious consequences in an enervated subject. The same thing is observable in our northern summer; the proverbially severe and persistent "summer cold" is especially prevalent after a long hot spell, and follows a decline in the temperature that would almost escape attention in the cold season. This invariably acquired thermic hyperæsthesia is alone a sufficient

reason for laying down the general rule that the hot climates and seasons be excluded absolutely from our therapeutic armamentarium. Their harmfulness is, indeed, being more and more widely recognized, so that the old practice of sending invalids to such regions as the West Indies is rapidly falling into complete desuetude.

The Variability of Temperature. We usually measure the variability of the temperature by the amount of rise or fall from day to day, employing as guides either the daily means or the temperatures at a fixed hour. It is also of advantage to note the excessively rapid changes that occur more or less frequently in the more variable climates, such as that of the eastern United States. From the purely mathematical point of view, the method just stated is unquestionably correct; applied to the human organism, it gives a distinctly false impression. It is certainly not true that we feel a fall from 30 degrees to zero as much as one from 60 to 30, the reason being that we instinctively refer all our thermic sensations to the indifferent point, regardless of the actual graduation of the thermometer; as the temperature departs farther from the indifferent point, our perception becomes progressively less keen. A drop from 80 to 50 degrees, as sometimes occurs in spring, is felt most acutely, for the change is from above the indifferent temperature to below it. A similar fall from 50 to 20 degrees is far less trying, and one from 20 to −10 incommodes us only moderately; temperatures below zero all feel very much alike, so that travelers may honestly report that −30 degrees in Canada seem no colder than zero in Pennsylvania.

The above sketch accounts for the popular impression of the changeableness of the temperature in spring; purely mathematical data show plainly that the winter months are very much more variable; they do not, however, appear so to the human organism. We here have one of the many instances in which purely theoretical considerations on climatic questions are altogether misleading.

A sudden rise of temperature affects us far less than an equal fall. The former almost always takes place during the daytime, when a certain elevation is expected in any case; the latter is relatively harmless when it occurs during the night, but more serious during the day, when we are apt to be out of doors, and prepared for a rise of temperature instead of a fall. Furthermore, we must again recall that man, being essentially a tropical animal, can withstand a rapid warming better than a sudden chill.

Sensible Temperature. It was Harrington[1] who first popularized the idea of "sensible temperature," regarding as such the temperature indicated by the wet-bulb thermometer, to which the surface of the body is far more akin than to the ordinary dry thermometer. His method is not quite accurate, as he does not allow for the cooling effect of air currents, but the wet bulb alone far more closely represents the modification of temperature by humidity as felt by the moist human skin than any other simple means; we may therefore avail ourselves of his idea with profit. The following table gives a few sensible temperatures, by way of illustration, and for reference; low temperatures being

[1] International Med. Magazine, August 1894.

omitted as unimportant for our purpose, and to save space:

Dry Thermometer	Humidity								
	90%	80%	70%	60%	50%	40%	30%	20%	10%
110	107	104	100	96	92	87	82	76	70
100	97	94	91	87	83	79	74	69	63
90	88	85	82	79	75	71	67	63	58
80	78	75	73	70	67	64	60	57	53
70	68	66	64	61	59	56	53	50	47
60	58	56	54	52	50	48	46	44	42

We see that 110 degrees in Arizona, with the humidity at 20 per cent., feel about the same as 90 degrees in New York, with 50 per cent. of moisture, but we must not carry this line of argument too far. Exposure to the sun is a very different thing in the former place from such in the latter; furthermore, the breezes at these respective temperatures feel altogether different, one being far above the body temperature, the other well below it. As stated above, Harrington's method tells only part of the story; the Arizona summer is warmer than that of New York, and the dryness of the air only partly mitigates its fervor.

Vincent[1] attacked this problem from another viewpoint. He determined the coefficient of reduction for the surface warmth of the body, at temperatures below the blood heat, and found that it amounted to 0.3; thus the temperature of the skin falls nine degrees as that of the air falls thirty. The cooling effect of breezes he calculated at about one degree F. for each mile per hour; the effect of insolation at about one-fifth of the difference between the shade and sun temperatures, the latter being read on the black bulb in vacuo.

[1] Quoted from Hann, Klimatologie, Vol. I.

Thus, on a very hot summer day, with the temperature at 100 in the shade, and a ten mile breeze, the sensible temperature, according to Vincent, is 90; in the sun, with the black bulb registering 150 degrees, it runs up to 100. On a cold winter morning, registering zero, the sensible temperature is 70 degrees if the atmosphere be calm, falls to 60 in a ten-mile breeze, but may again be raised ten points by seeking a sunny spot, where the black bulb records 50 degrees.

Vincent does not seem to recognize the importance of the relative humidity; he very wisely does not allow for clothing, whose influence is beyond accurate calculation. It is interesting to note that, according to Vincent's formula, the cutaneous temperature, when that of the atmosphere stands at 80, registers about 94 degrees, the indifferent temperature in water, and to observe the agreement with the empirical data set down on pages 7 and 8.

Harrington's method of determining the sensible temperature is the more generally practical of the two; it recognizes the importance of the relative humidity, and the whole subject is of relatively little interest at those low temperatures where the wet thermometer becomes less reliable unless employed by specially trained experts. For the amateur, the hair hygrometer is a sufficiently useful instrument, and in combination with the table just given is adequate to meet all ordinary requirements.

As to Vincent's methods, the determination of the sun temperature can be made only with the black-bulb-in-vacuo thermometer, which requires some experience in handling; exposure of an ordinary thermometer to

the sun's rays gives results that are quite worthless, for even such trifles as the thickness of the glass and the shape of the bulb affect the readings materially. The wind correction is still more difficult of application, for while measurements on the towers of the weather stations may easily be made very accurate, they give no idea of the actual air movement on the irregular surface of the earth, where alone we are exposed to the winds, and their gauging is quite impossible. Vincent's method will therefore remain of only academic interest, though its theoretical value is indisputable. A combination of both his and Harrington's would probably cover the ground most thoroughly of all. All the other plans for determining the temperature, as actually felt, are far too complicated for general use, as they invariably call for the mastering and employment of complicated mathematical formulæ.

Cloudiness. Excessive cloudiness is an objectionable climatic factor; it is not only a psychical depressant, but cuts off much of the beneficial effect of sunlight, to be noted presently; a ratio of cloudiness exceeding 70 per cent. of the possible total impairs a climate very seriously. So high a proportion is not uncommon in many parts of the temperate zone during the winter months; just then, however, the shortness of the day renders sunshine none too abundant even in fine weather, so that any loss through cloudiness is an important matter. Apart from this aspect of the case, which is largely psychical, we must devote a few lines to a discussion of the widespread belief that a lack of sunshine favors the dissemination of infectious diseases; there is probably some justification for this opinion, but the influence of

cloudiness on disease has been exaggerated. Ruhemann[1] seemed to present a strong case, when he attributed the prevalence of influenza in Berlin in January, 1900, to the almost total absence of sunshine, there having been only ten hours during the entire month, 2½ per cent. of the possible total, whereas the normal proportion for that place is 14 per cent. This last allowance is assuredly little enough, and exceeded almost everywhere in temperate North America, save perhaps at a few points on the south shore of Lake Ontario. Yet, if Ruhemann's contention were sound, our Middle Atlantic Coast, with an average allowance of 135 hours of sunshine in January, 45 per cent. of the possible total, should be almost immune to epidemics of this disease. Anders,[2] moreover, in a comprehensive analysis of this subject for Philadelphia, showed clearly that cloudiness and influenza bear no intimate relation to each other. It is also a recorded fact that our first and most violent outbreak of this disease took place in the phenomenally mild, sunny and almost spring-like winter of 1889-90. Thus no true point of contact can be proved, and the effect of cloudiness on epidemic disease remains indeterminable. Still, sunshine is of indisputable value in winter in elevating the temperature during the day, and giving the individual basking in it the benefit of direct heat and light radiation; its germicidal usefulness will be touched upon presently.

There is a reverse side to this question, little appreciated, but not hard to understand. There is, particularly in summer, such a thing as too much sunshine

[1] Berliner klinische Wochenschrift, February 26, 1900.
[2] Journal of Balneology and Climatology, October 1902.

during the warm season, a little relief through the intervention of clouds is often grateful. We shall have occasion to return to this subject, and mention here only that the almost cloudless climates are quite as irritating as the gloomy ones are depressing; an excess of everything, even fine weather, ceases at last to be either attractive or healthful.

We may refer again to the psychical effect of cloudiness and its absence, which may be ignored in a healthy person, but is of some account in an invalid. A clear sky is distinctly stimulating, a cloudy one as positively sedative; the mixed conditions characterizing our eastern spring and summer seem to be the most generally beneficial. This matter is of relatively little importance in such sections as our Atlantic Coast, where the seasons differ but slightly in this respect; in most regions, however, they are unquestionably of great moment, and well worth consideration, as any one can convince himself by spending a year in our lower Lake Region or in central Europe.

Rain, Snow and Fog. An ample rainfall, if not too frequent, and well distributed through the year, is always a good climatic feature, as it purifies the air and checks the formation of dust. The amount of rain on any one occasion is almost immaterial, provided it be sufficient to fulfill this purpose; its duration is more important, since an excess of rainy weather interferes with outdoor exercise, and acts as a psychical depressant even more than mere cloudiness.

Most cool climates have a relatively small precipitation during the winter; as little moisture is required at low temperatures, owing to the small amount of

evaporation, this is of no consequence and perhaps even advantageous, for a wet winter is invariably productive of mud and slush. More important is the consideration of such regions as have a dry summer. If rain be totally absent, the air and dust undergo a certain amount of sterilization by drying; the annoying clouds of pulverized matter, that penetrate through the finest crevices, are at any rate shorn of some of their power for mischief. A hot and merely dry summer, however, is an almost unmitigated evil, for the amount of moisture is insufficient to lay the dust on the one hand, and ample for the maintenance of bacterial life and development on the other; such a summer climate is almost always unwholesome.

In cold climates, a permanent winter snow-sheet is in every way desirable; it facilitates travel and an outdoor life, and keeps the air pure by making dust impossible. This winter snow-sheet has but one drawback; it is apt to melt rather suddenly in early spring, turn the countryside into a quagmire, and render the air exceedingly damp and chilly. Where the winter temperatures fluctuate about the freezing point, and the cold weather is intermittent, such sloppy and damp conditions may be expected during a considerable portion of the cold season; it is therefore best to avoid this type of winter climate altogether, if the total precipitation is at all large; the steadier, if more severe, cold farther north is in every way preferable.

There are two kinds of fog. The first comes in from the sea, is relatively mild in winter and cool in summer; as it creeps inward it grows denser in the former season, but becomes dissipated in the latter. This type of fog

is wholly objectionable, if at all frequent, and mars many an otherwise desirable seaside resort. The fog that forms over valleys and plains on calm nights is perhaps less harmful, for, even in winter, the accompanying absence of wind partly compensates for the dampness. In cities like London, however, where the cold winter fog becomes so loaded with soot as to be impenetrable and suspend all traffic, it is injurious in a high degree, regularly causing an upward leap in the death-rate.

Winds. Steady and moderate air currents are essential to a wholesome climate, but a good deal depends on the season, and strong winds that might be agreeable in summer become most unpleasant and even harmful in winter. Calms are not very desirable, being the chief cause of the second species of fog, as well as of frost, both of which are due to rapid radiation from the earth's surface on clear and quiet nights. The temperature, on such occasions, rapidly falls to the dew-point, and the atmospheric moisture is condensed. We can understand that such mists and fogs form most readily in surface depressions and mountain-bordered valleys; such sites are therefore to be shunned, and hillsides to be chosen in preference.

Frequent and violent storms are objectionable in every way, and regions subject to cyclones, tornadoes or numerous thunderstorms are utterly unsuited to invalids. Thunderstorms, in particular, act as a powerful mental and physical excitant, and are extremely trying to many neurotic subjects. Even aside from true storms, continuous high winds are very injurious to invalids, though often merely bracing to robust persons; the cold winds of the mistral type, that prevail on a hilly coast with a

cold hinterland, are the worst of all, but the high dust-laden winds of summer on the Great Plains are nearly as bad. An important exception may, however, be made in favor of the summer sea breeze; even if occasionally violent, it nevertheless brings with it the even temperature and pure air of the ocean, and is therefore tolerable and even salutary, unless it attains the force of a gale, as often happens on our North Pacific Coast.

Hot winds are a direct excitant, and altogether harmful. It is customary for the dwellers in the desert or semi-arid West to laud the dryness of the heat, but much of the advantage conferred by the low humidity is neutralized by the furnace-blasts that make such regions a veritable inferno whenever the thermometer rises toward 100 degrees in the shade. It also is not true that these conditions are perfectly safe; the contrary is evidenced by the frequency of heat-stroke in India during the very dry hot season, which closely resembles the summer of our own extreme Southwest.

It is, of course, hardly necessary to warn invalids, especially if neurotic, against taking up their abode in regions where every spell of sultry weather leads the natives to scan the western horizon for funnel-shaped clouds, and think of their tornado-cellars; one might as well ask a patient to choose a residence on the side of an active volcano, and expect him to do well in spite of the constant nervous strain to which he will necessarily be subjected.

The Atmospheric Pressure. The fluctuations of the atmospheric pressure at any fixed level, ranging as a rule within two or three inches of mercury, are of little physiological importance, but the variations according to

altitude are sufficiently great to call for extended discussion. Removal of an individual to a higher or lower level furnishes an effective method of applying so-called pneumatotherapy, though its range is here somewhat limited, and its value eventually lost by acclimatization. The inhabitants of regions near the sea level can, of course, avail themselves of higher levels only, for the purpose of breathing rarefied air. Those who have dwelt at medium altitudes may either ascend or descend, in the latter event obtaining such benefits as may be afforded by the respiration of compressed air. The latter aspect of this subject has hardly been studied at all, and the transfer of patients from the mountains to the seaside has hitherto been employed but rarely, and with little definite purpose.

The average air pressure at various levels, reduced to the temperature of 32 degrees, is as follows:

Elevation, Feet	Pressure, Inches of Hg.	Elevation, Feet	Pressure, Inches of Hg.
0	30.0	10,000	20.3
2,500	27.3	12,500	18.3
5,000	24.8	15,000	16.5
7,500	22.4		

Thus, removal to the elevation of 5,000 feet deprives the individual of one-sixth of his normal supply of air, and an additional 5,000 feet cut off another sixth. So great a change must necessarily entail important physiological consequences, which it will be worth our while to study with some minuteness.

The Physiology of High Elevations. Viault,[1] in the course of a scientific tour in the Andes, was the first to

[1] Comptes rendus de l'académie des sciences, Vol. 111.

demonstrate the remarkable blood changes at high elevations; he found that the dwellers at an altitude of 14,400 feet exhibited an increase in the number of red blood cells from 5,000,000 to 8,000,000 to the cubic millimeter. Egger[1] made similar examinations at Arosa, in the Alps, 5,900 feet above the sea; his observations showed a gain of only 2,000,000 red blood cells. Wolff and Koeppe[2] then proceeded to examine their patients at Reiboldsgrün, 2,300 feet high; they reported an increase of only 1,000,000. These observations, which have obtained ample confirmation by other investigators, show an inverse ratio between the air supply of the individual and the number of erythrocytes in his blood.

For a time, certain critics made claim that this increase was only apparent. Grawitz[3] asserted that concentration of the blood through increased transpiration of the body fluids fully accounted for the relative numerical increase of the suspended corpuscles at high elevations, the actual change being a diminution of the plasma. It is not difficult to offer a simple and final objection to Grawitz's explanation; no loss of body weight or fluid takes place at high levels, as would be inevitable in case of increased transpiration; as a matter of fact, the lower temperature at elevations tends to check perspiration, not increase it. Gottstein[4] urges that the apparent increase in the number of erythrocytes rests on a fallacy, and that the Thoma-Zeiss apparatus, the one regularly employed, is adapted only to use at the sea-level. It is not easy to follow Gottstein's train of

[1] Correspondenzblatt für schweizer Aerzte, 1892, p. 645.
[2] Münchener med. Wochenschrift, 1893, No. 11.
[3] Berliner klin. Wochenschrift, 1895, Nos. 33 and 34.
[4] Allgemeine med. Centralzeitung, 1897, No. 74.

thought, but if he supposes that the density of the blood serum is materially affected by the atmospheric pressure, he exhibits a strange ignorance of the laws of hydraulics, for liquids are so slightly compressible, that the error at 10,000 feet does not amount to more than 0.001 of one per cent. for a watery fluid like blood-serum; in other words, it is infinitesimal.

It is difficult to avoid the conclusion that the whole matter is merely a compensatory hypertrophy of the blood tissue, in response to the extra work imposed upon it. The first point sustaining this view is the almost exact inverseness of the ratio of air to blood-cells, but the best evidence in favor of the hypertrophic theory is furnished by the gradual development of the cellular increase, and the concomitant, but somewhat tardier, increase in the amount of hæmoglobin. The observations made by Kündig[1] at Davos give the following result:

Amount of Increase of	Erythrocytes	Hæmoglobin
First week	11.1%	7.4%
Second week	16.3%	14.1%
Third week	21.3%	20.5%

It is clear that removal to a considerable elevation acts also as a general stimulant to metabolism, for so extensive an hypertrophy of the most important tissue of the body, namely, the blood, must inevitably react upon the entire organism. It necessarily follows that a sudden and extreme change of level is not suited to every constitution; the strain imposed during the first three weeks may be too great for a person suffering from impaired general vitality; on the other hand, it is plain

[1] Correspondenzblatt für schweizer Aerzte, 1897, p. 2.

that a gradual ascent will frequently obviate this difficulty. After a four weeks' stay, it is possible to decide definitely whether the locality selected is or is not salutary to the individual under observation.

A circumstance, noted by Weinzirl,[1] and hitherto unexplained, is an excess of about 500,000 erythrocytes in winter, as compared with summer: the place of observation was near Albuquerque, N. M., at about 6,000 feet elevation, but, somewhat curiously, higher in the summer camp than in winter quarters; we should have expected exactly the opposite change. We cannot, however, entirely exclude errors of observation, and his report is somewhat fragmentary.

Observers seem to agree that high-level residents show as a permanent condition a somewhat increased oxygen inhalation and carbohydrate metabolism. The former is in accord with the increased amount of hæmoglobin, the latter is an inevitable consequence of the former; both become especially marked when vigorous exercise is indulged in (Bürgi).[2]

Mountain Sickness. An excessively abrupt and extreme transfer from a low to a high level brings on the symptoms characteristic of an acute anæmia, precisely similar to that resulting from a profuse hæmorrhage. It affects individuals to a varying degree, those previously anæmic naturally suffering more readily and acutely than the robust. At the height of 16,000 feet, where the supply of air is just one-half of that at the sea-level, even the most sturdy person will succumb, if he ascends to this height rapidly and by means of the arduous

[1] Amer. Journ. of the Med. Sciences, August, 1903.

[2] Archiv für Anatomie und Physiologie, 1900, No. 506.

exertion of climbing. Whymper,[1] seasoned as he was by the most strenuous Alpine tours, practically collapsed at the stated level in the course of his first ascent of Chimborazo, having approached that mountain rather rapidly from the Pacific Coast; after a rest of some days, he accomplished the final climb to the summit (21,000 feet), but with difficulty. Later on, being then quite accustomed to the rare atmosphere of the Ecuador plateau (10,000 feet), he climbed the same mountain, as well as others, without any noteworthy distress.

It is now generally agreed that Egger[2] is right when he claims that mountain sickness is nothing more than the expression of a relatively acute anæmia; as this anæmia disappears in the course of the hypertrophy of the blood elements, the distressing symptoms gradually vanish.

Phototherapy at High Elevations. Nowadays, when the study of radiant energy and its therapeutic application is so much in the foreground, we cannot discuss high altitudes without referring to the peculiar modification of the solar rays at these levels. The radiant emanations—or undulations—from the sun, in passing through the terrestrial atmosphere, encounter a highly absorptive medium; their absorption is partly due to the fact that air is a complicated and not uniform gaseous mixture, not a pure gas, but is caused chiefly by the presence in the air of a large and unevenly distributed amount of watery vapor. All the solar rays are affected to some degree, but the ultra-violet most of all; as the ultra-violet rays just now occupy the center of the stage, we shall consider them first. The following table, after

[1] Travels among the Great Andes of the Equator, New York, 1892

[2] Loc. cit.

Bunsen and Roscoe,[1] shows the proportion of chemically active rays reaching the surface of the earth, at various levels and sun altitudes, in percentages:

Elevation, Feet	Altitude of Sun		
	70 deg.	50 deg.	30 deg.
0	42%	34%	19%
4,000	47%	39%	24%
8,000	53%	46%	30%
12,000	59%	53%	37%

Saake[2] showed, in a recent communication, that the atmospheric radioactivity at Arosa (5,900 feet) is three times that in the lowlands, and points to a possible relationship between this circumstance and certain therapeutic results in tuberculosis, one of the many affections now being subjected to radiotherapy. It is also more than likely that the excess of ultra-violet rays, at high elevations, is responsible for the liability to sunburn to which mountain-climbers are exposed. It is, at any rate, certain that the reflection from snowfields, formerly regarded as the exciting cause, is not essential, for Langley[1] suffered severely from sunburn in his ascent of Mt. Whitney (14,600 feet), though his route led entirely over rocks.

More apparent, and therefore more striking, is the proportion of solar heat that escapes absorption at high altitudes. The sun-thermometer gives higher readings in the upper Alps, than at their foot, though the shade temperature is much higher below. This advantage is enhanced in winter by the coincidence that the high valleys suffer less from clouds and mist than the foothills. We can readily understand from this how visitors to the

[1] Quoted from Hann, Klimatologie, Vol. I.

[2] Münchener medizinische Wochenschrift, 1904, No. 1.

Engadine and Colorado can go about in the sun quite lightly clothed at shade temperatures well below the freezing point.

The field for the application of a mild photo- and radiotherapy at high elevations is therefore quite extensive, and well worth further development. Little has, however, been done so far, as the more powerful and tangible forms of radiant energy have hitherto almost monopolized the interest of the scientific world.

The Temperature at Elevations. In theory, the fall of temperature in ascending from the sea level is governed by a well-defined law; practically, however, modifying factors step in. The chief exception is due to what is called the inversion of temperature, in rugged regions where intense cold may reign in the deep valleys while the mountain-sides are basking in a mild sunshine. In some districts this phenomenon is quite temporary; in others it is apt to prevail for days at a time during the presence of a persistent high barometric area, especially when the ground is snow-covered.

The effect of altitude on the daily range of temperature varies. On towers or isolated peaks, the daily range is very much diminished, for much of the diurnal radiation from the earth is lost; the reduction amounts to as much as four degrees on fine days on the roofs of our loftiest sky-scrapers. The temperature does not continue to rise until three or four o'clock, but begins to fall as early as two or even one P.M. On high plateaus the case is quite different; the radiation from the earth's surface is even greater than on low plains, because of the rarer atmosphere, and, as stated before, the solar radiation is also relatively great; the result is an absolute

increase of the daily range as compared with the lower situations.

The seasonal range regularly diminishes with the altitude, very rapidly in rugged districts, where the deep valleys are the seat of frequent inversion of temperature in winter; more slowly on continental elevations, where inversion is not conspicuous. At the height of only a few miles the difference between summer and winter becomes quite insignificant.

We may here append a few figures. On mountain peaks the fall of temperature is about three degrees per thousand feet, measured from the sea level. Plateaus are relatively warm, the temperature then falls with increased rapidity to the surrounding summits. Inversion of temperature often causes a marked diminution of the fall upward, especially in winter, when the mountain slopes may be warmer than the valleys for weeks at a time. The dynamic warming and cooling of the air currents in descending and ascending, respectively, amount to five degrees per thousand feet, and the predominance of one or the other flow materially affects local averages. As descending currents are common in winter, but infrequent in summer, the fall of temperature as one goes upward averages very much greater in the latter season.

The Seashore. I shall here refer only briefly to the peculiarities of marine climates, as the various details will receive ample illustration later on. The seaside is damper than the interior in summer, owing to the frequency of sea breezes; it is often a little drier in winter, but only relatively, because the air is warmer and less readily saturated. This distribution of humidity is

directly responsible for a similar one of cloudiness; to a lesser extent, this is also true of the precipitation, but here so many other factors step in that any rule would present numberless exceptions. The extremes of temperature are invariably modified by the presence of large bodies of water, an expanse of even thirty or forty miles producing a considerable effect; much depends on the prevailing wind direction.

The summer is invariably retarded along the coast, still more on islands; the winter is sometimes retarded even more, sometimes very little, local factors modifying the rule in many instances. For example, midsummer falls on the 20th of July on the Delaware River, on the 25th at New York City, on the 1st of August on southern Long Island, and on the 5th at Block Island; in winter, however, the retardation is barely a week in all. At Bermuda the mid-seasons fall on the middle of February and August respectively, whereas the Farallone Islands, off California, give February 1st and September 15th as the corresponding dates.

The average annual temperature at the seaside is elevated northward, depressed southward; the annual and daily ranges are very much reduced, especially where sea breezes predominate. It will be of interest to glance at a comparison of Baltimore (suburban) and Atlantic City, which lie on the same parallel, for the same period.

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Yr.
Baltimore .	32.8	34.9	40.1	51.6	62.6	71.8	75.6	73.4	66 5	55.6	44.2	36.4	53.8
Atlan. City	32.5	33.9	37.6	46.8	57.2	66.8	71.9	71.8	66.7	56.3	44.7	36.4	51.9
Difference .	−0.3	−1.0	−2.5	−4.8	−5.4	−5.0	−3.7	−1.6	+0.2	+0.7	+0.5	0.0	−1.9

Atlantic City is only semi-oceanic, as land breezes

prevail at all seasons, except occasionally between April and August; the reason for giving suburban data for Baltimore will be stated in the next chapter. In this semi-southern latitude (39.4) the ocean already lowers the annual average materially; the daily range is seven degrees less at Atlantic City from April to October, only three from November to March, the transition in spring and autumn occurring quite abruptly.

The annual range is 37 degrees at Nantucket, Mass., and 45 at Scranton, Pa., on the same parallel. Farther north we find a range of 43 degrees in Nova Scotia (only 33 on Sable Island) and 56 in the St. Lawrence Valley.

The wind velocity is about 50 per cent. greater on the coast than inland, two or three times as great on flat and small islands. This feature should never be disregarded in recommending marine climates; it is markedly diminished only a few leagues inland, unless the coast be exceptionally flat. The number of rainy days agrees quite well with the percentage of cloudiness, and does not correspond with the total amount of precipitation; some coasts are therefore subject to drizzling rains, others to torrential downpours.

The saline constituents of the sea air are minute in quantity, and of more than doubtful medical importance; we shall have occasion to recur to this subject later on, and here mention merely the widespread exaggeration of its value.

The Classification of Climates. For therapeutic purposes we may classify climates, first, according to the temperature; secondly, according to the relative humidity; thirdly, according to the altitude.

A convenient classification according to temperature is that of Köppen,[1] here slightly modified:

1. Hot climates. Every month averages higher than 68 degrees.

2. Warm climates. Every month averages higher than 50 degrees, one or more exceed 68.

3. Truly temperate climates. All months average between 50 and 68 degrees.

4. So-called temperate climates. The monthly averages range from below 50 to above 68 degrees. A better name would be "extreme climates."

5. Cool climates. All months average below 68 degrees, one or more below 50.

6. Cold climates. Every month averages under 50 degrees.

The fourth group is so very extensive in point of territory covered, as well as so rich in minor variations, that it may advantageously be sub-divided as follows:

4*a*. Warm temperate. Averages below 50 degrees are limited to the winter months.

4*b*. Middle temperate. The most extreme of all. More than three months both fall below 50 and exceed 68 degrees.

4*c*. Cool temperate. Averages above 68 degrees are limited to the summer months.

If we classify climates according to the relative humidity, we may form the following divisions:

1. Desert climates. Humidity under 40 per cent.

2. Dry climates. Humidity between 40 and 60 per cent.

3. Moderately moist climates. Humidity between 60 and 80 per cent.

[1] Meteorologische Zeitschrift, 1884.

4. Very moist climates. Humidity over 80 per cent. We must not forget that many localities vary according to the season, belonging to one class in winter, and to another in summer. As a rule, spring and summer are the driest seasons, but at many marine stations summer is much damper than winter. The tendency to a dry spring and moist autumn is almost universal in the temperate zones.

The third classification, according to elevation, is the one on which there is most nearly a universal agreement; it has been settled to designate as low levels all those under 1,000 feet; those up to 3,000 feet may be called moderate elevations; above that, high levels.

The summary of these three methods of classification gives an array of varieties that is almost bewildering; even though some combinations do not actually occur, still the total is very great. We cannot attempt to unravel this apparent tangle until we have given an outline of the climatic types that have a definite value in therapeutics; when this has been done, a systematic grouping will present no special difficulty.

General Application. With the above immense variety of climates at our disposal, we nevertheless realize at once that their applicability lies within readily defined limits. We have already excluded the hot climates from the field of therapeutics, and some of the others are also objectionable at certain seasons, or useless for particular purposes. We must, furthermore, regard the previous habituation of the individual applying for treatment; for changes of climate are, to a certain extent, relative. The general proposition may be concisely stated as follows:

Residents of hot and warm regions may profitably avail themselves of a measure of climatic training by removal to a cooler region; it is impossible to spare their organs by the employment of a warmer climate; this involves no appreciable change for them, and they are apt to come to us already somewhat enervated.

The inhabitants of temperate regions may avail themselves either of sedative treatment in a warm climate, or of bracing conditions in a cool one; they thus enjoy more extensive opportunities. In the climates that I have designated as truly temperate, the very evenness is likely to cause some enervation; here a visit to a cool region is sure to do good. The same treatment is often also desirable in the summer months of the extreme climates; the residents in many extreme climates have in fact two bad seasons to contend with, namely, a hot and enervating summer, and a winter that keeps the less robust indoors much of the time; here the field of climatotherapy may be very extensive indeed.

So far as temperature goes, the only climatic treatment that the inhabitant of a cool region is likely to require is removal to a mild winter resort. This may be chosen so as to have either a sedative or a training effect, and here a high degree of professional skill will be well rewarded, whereas mere routine management may do no end of harm.

The residents of cold climates are largely excluded from the benefits of climatotherapy. Change of climate necessarily means to them increased warmth; this inevitably involves the dangers incident to at least relative enervation, which will make a return to their former homes perilous. The risks of permanent removal from

a cold to a mild region are illustrated by the sad fate of the Cape York Eskimos in the far from genial climate of New York City; the results are even worse than those attached to a transfer from New York to the tropics. Thus the inhabitants of cold countries must seek health within their own climatic range.

On the other hand, the benefits often derived from a higher elevation are not limited to the inhabitants of any zone; such limitations as exist are strictly individual, and will be pointed out later on. The effect of a dry, as opposed to a moist climate, has been gone into so fully as to require no repetition here.

Application to Childhood. The above rules require material modification in adapting them to infants and children. First and foremost, children are far more sensitive to cold and temperature changes than adults; we all know that their extremities become cold and even cyanotic at temperatures that are quite congenial to older persons. This difference must be regarded as normal, and is due to the following causes: In the first place, the protective accumulation of adipose tissue, aside from that peculiar to the milk-fed and inactive infant, does not usually become extensively developed until well after puberty. Secondly, the child's metabolism is so largely devoted to the building up of new tissue, that a relatively small caloric surplus remains to meet adverse external conditions. Thirdly, the city child is, as a rule, deficient in that combination of resisting powers which we commonly call robustness; but here I must admit that my experience, though somewhat limited, does not speak for any universal superiority in this respect among country-bred children, compared with

those raised in large towns under reasonably good hygienic conditions. Urban sanitation is becoming so far superior to that of rural districts, in a number of respects, that the advantages of the latter, conspicuous some decades ago, are now less in evidence. Recently collected data seem to show, in addition, a marked physical deterioration in the rural population of some of our eastern states, which does not apply equally to most western sections.

In later childhood, some of the sensitiveness to low temperatures, just outlined, is compensated by a greater physical activity and relatively elastic metabolism, shown by the enormous possibilities of the juvenile appetite. These reserve forces, however, can be drawn upon only intermittently, and are often gravely abused. Excessive strains in childhood are fertile sources of various organic weaknesses in later life; for an example I need not go further than to refer to the premature degenerative processes that follow the strenuous pursuit of athletic sports by growing boys. In infancy the stated compensations are not at all available, and the same is true, in a gradually diminishing degree, up to about the seventh year. Until the age of one-and-a-half to two years, exercise cannot, of course, be counted on at all, and after that, for some years more, its rôle increases only very slowly; in this direction there is fortunately no great danger of injury from trying to overdo matters. On the other hand, any attempt to stimulate the metabolism of young children to abnormal activity by forced feeding is certain to result in disaster; the digestive functions break down at once in infancy, more slowly, but just as surely, in young children; thus

this resource, valuable as it often becomes in later life, is absolutely barred in infancy and early childhood.

Later childhood would probably present a gradual transition from the extreme sensitiveness of early life to the greater hardiness of maturity, if new adverse factors did not come into play in the seventh year. A child of that age may have become quite sturdy and robust, and able to resist unfavorable external conditions fairly well, when it is suddenly deprived of the best part of its time for outdoor play by the demands of the school. This matter would not be so bad if the trying school régime, with its severe physical discipline, were made to act on the youthful organism gradually, beginning with two and three hour sessions during the first year or two. Here, however, the child's physical welfare obtains scant consideration; iron-clad school regulations, as well as the desire of selfish or busy parents to have their children out of the way, are paramount; so we see fairly hearty children rapidly becoming flabby and anæmic as their best time is spent indoors, the care of their bodies being entirely sacrificed to an ostensible zeal for intellectual development. As a matter of fact, most of the time spent in school during the first year or two is wasted in the worst possible way; with the customary unwieldy classes a child spends the whole day in acquiring but a small modicum of knowledge. The young mind confessedly can grasp but few facts at a time, yet, to instill that minimum, the greatest part of the day is spent in a stuffy schoolroom. It is only too well known that, in our great cities, the early acquirements of school-children consist chiefly of one or more of the infectious diseases, besides vicious habits of eating in the form of

the bolting of food and the ingestion of portentous masses of cheap and harmful confectionery, usually supplied by a dealer conveniently located next door to the school. School life thus implies a distinct set-back in the physical condition of the child, the progress that would be expected with advancing years is not realized.

We have seen the disadvantages under which children labor in the effort to adjust themselves to low temperatures; the net result is an elevation of the indifferent temperature as compared with adults. We must therefore modify materially the general scheme of climatotherapy in applying it to children, and, in almost all cases, select warmer regions for the very young than would be either required or desirable in treating older persons.

Above the indifferent point, the variations due to age are equally marked; children, especially young infants, tolerate great heat very badly. Older children, to be sure, indulge in lively play in the sun, at temperatures quite unendurable to their elders, but we have no reason to regard this sort of exposure as harmless. It is true that typical heat-stroke is rare in children, but this is chiefly because the heart and kidneys, which are charged with the duty of combating the tendency to hyperpyrexia, are still undamaged by the accumulated wear and tear of many years, and by chronic intoxications such as alcoholism. Still, everything considered, even if we make allowance for the elevation of the indifferent point in early life, we may safely assume that prolonged and violent exercise at a shade temperature of 95 degrees, and a sensible temperature of 80, both of which are common during our hot spells, is very injurious to young as well as older children.

It is well known that children of white parentage do very badly in the tropics near the sea level; the regions bordering on the temperate zone, having a somewhat lower temperature in the dry season, as well as elevated sites, are often very much less dangerous, but, at their best, deprive the children, as they grow up, of the physical training afforded by cool weather. In all cases that do not succumb in early life, there is marked enervation and a low power of resistance to morbific influences of all kinds.

As to elevations, there is some diversity of opinion. European observers discountenance the sending of children under six or eight years of age to the higher Alps; as the July temperature there averages only in the fifties, their attitude is quite correct, for young children and infants require a much warmer summer climate. In our Rocky Mountains this objection does not apply, and fairly robust children, even those of tender years, accommodate themselves quite readily to the consequent blood changes and heightened metabolism. As to middle elevations, there is more agreement; an altitude of 1,500 to 2,000 feet is certainly beneficial to all save a few greatly enfeebled children. It is worth mentioning that stimulation of the digestive functions is a much safer procedure in the pure, cool and somewhat rarer atmosphere of our eastern hills than at lower levels; a burdening of the stomach and intestines that would be hazardous at the seashore is well borne and even advantageous in the mountains.

Climate and Disease. Many diseases are more or less uniformly distributed over the globe, and but slightly, if at all, influenced by climate; a considerable number

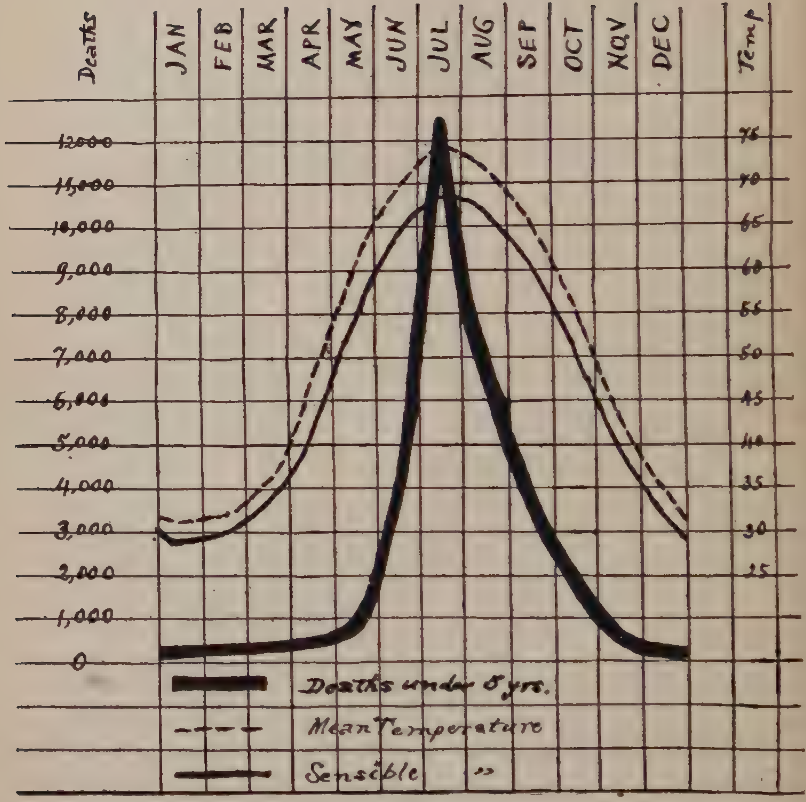
are more or less modified by atmospheric conditions; a few are almost entirely subject to them, being absolutely limited to certain zones and seasons.

The frequency and severity of digestive disorders in children are almost in a direct ratio to the temperature, more accurately, perhaps, the sensible temperature. They are relatively mild and uncommon in cool weather, but increase suddenly as the season grows warm, assuming an alarming distribution and seriousness when the indifferent temperature is passed. Chart I (see opposite), modified after Seibert,[1] illustrates this point in telling fashion. It gives the number of deaths from diarrhœal diseases in New York City among children under the age of five years, and the mean temperature, by months. I have taken the liberty of adding the sensible temperature.

The reader will observe that the rate of mortality remains uniformly low until the average sensible temperature reaches 55 degrees (middle of May); then a rapid rise occurs as the temperature goes up. A fairly rapid and continuous fall takes place as the season turns (end of July), but there is no complete remission until the mean sensible temperature again falls below 55 (early October). Some of the slight excess in October is probably due to the eventual death of severe and chronic cases holding over from the summer.

That the summer temperature of New York is very far above the danger point is also shown by the data for Berlin[2], where the summer is about eight degrees cooler; July in Berlin having exactly the temperature of

[1] Med. Record, March, 1888.
[2] Berliner klinische Wochenschrift, 1904, p. 1163.



Deaths
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Temp
12000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
75
70
65
60
55
50
45
40
35
30
25
Deaths under 5 yrs.
Mean Temperature
Sensible "

CHART I

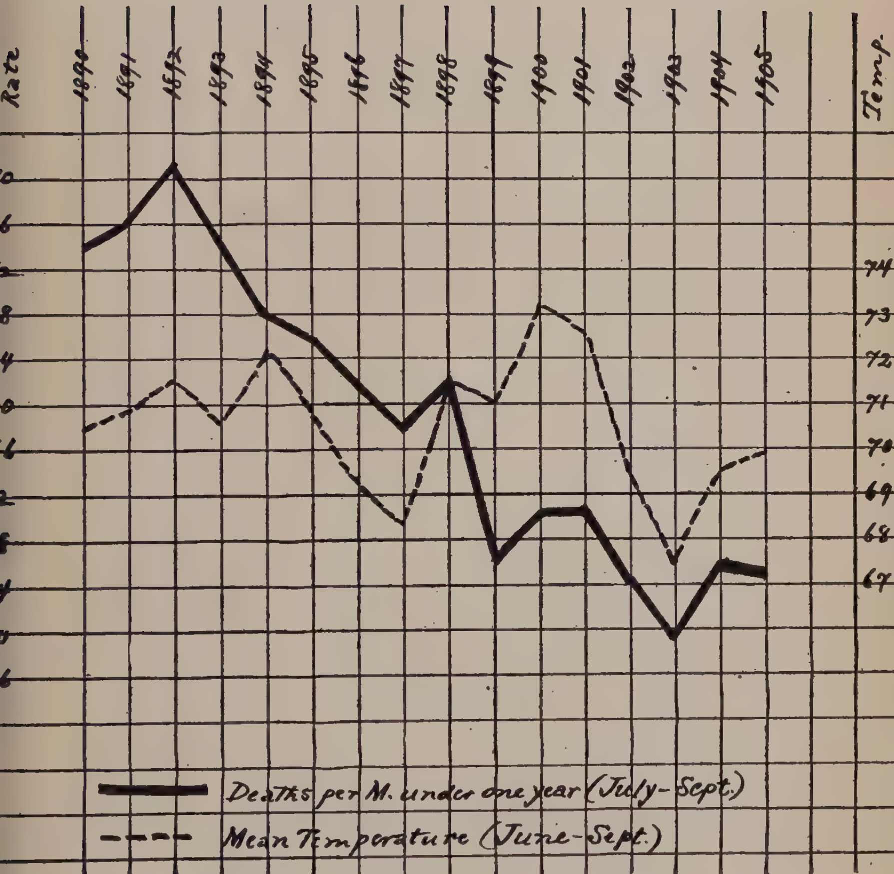

Rate
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
Temp.
74
73
72
71
70
69
68
67
Deaths per M. under one year (July-Sept.)
Mean Temperature (June-Sept.)

CHART II

September in New York. In hot summers, in Berlin, the deaths under the age of one year, which average about 725 per month from January until May, increase to 850 in June, 1,310 in July, and 1,970 in August: in cool summers, which seem very cool indeed to an American, the figures are very much lower. It will be observed that in Berlin the maximum occurs in August, instead of July, as in New York; this is almost certainly due to the fact that the intense heat and high humidity in New York prove fatal to delicate and badly managed infants before the summer is half over, whereas the less extreme conditions in Berlin are more apt to lead to subacute and chronic affections, which prove deadly only when the heated term is prolonged into August. In hot years the figures for Berlin compare very unfavorably with those for New York, considering the vast difference in climate; on the other hand, we must not forget that improved infant hygiene has materially reduced the New York mortality in recent years, whereas in Berlin systematic warfare on the summer diarrhœa of infants by the health authorities is still only in its early stages.

The figures for New York have been relatively low in recent years; among northern cities Boston and Detroit, both considerably cooler, furnish less favorable reports; the same is true of Philadelphia, where a somewhat warmer summer is compensated by better housing conditions. The large cities doing better than New York—namely, Chicago, Buffalo and San Francisco—are all very decidedly cooler in summer. For the rate of progress in New York, see Chart II (opposite).

The reason for this terrible infant mortality in summer is in part the relatively feeble resisting power, previously

referred to; but a still greater part must be assigned to the staple diet of children, namely, milk, which so readily undergoes decomposition at moderately high temperatures. Thierfelder and Günther[1] found that the lactic acid bacillus flourishes most luxuriantly at 82 degrees, exactly the mean summer temperature in the tropics, whereas its growth becomes totally arrested at 50 degrees. The relation to our charted data is obvious, as is also the prophylactic indication. In a recent article[2] I have endeavored to show, by means of a statistical investigation, that the greater part of the death-rate from infantile diarrhœa may be obviated by sanitary measures, such as have been widely adopted since the publication of Seibert's paper. The net results have been embodied in the preceding chart (II); it will appear that an effective reduction has been achieved within the past fifteen years, but that the limit is in sight, as our summers cannot possibly be rendered altogether innocuous. The few degrees of difference between our warmest and coolest summers play an unimportant rôle, for all range very far above the danger point, which stands at 55 degrees when no precautions whatever are taken.

On Chart II, as in the Berlin data, no attempt has been made at a classification of diseases, but, during the third quarter of the year, the overwhelming majority of deaths under one year are attributable to gastro-intestinal affections, either primarily or as a complication.

The supposed tendency to respiratory disease in winter is more doubtful. We shall discuss the question of "catching cold" in a later chapter, and content

[1] Archiv für Hygiene, 1897, vol. 25.
[2] New York Med. Journal, September 9, 1905.

ourselves, for the present, with stating that sudden temperature changes, as previously indicated, are more potent in setting up a disturbance in the respiratory tract than mere cold. We thus comprehend the established fact that pneumonia, at least in children, is commonest in the spring, and that the climates most associated with it lie well to the south. In Europe it is commoner in central and southern Italy than farther to the north (Hirsch), and we are now thoroughly familiar with its relative rarity in cold regions like Greenland. In the United States the census reports regularly show an excess in the southeastern states, especially in such mild and still very changeable climates as that of Arkansas. Concerning the tropics, all travelers agree on the relative frequency there of this disease; in Angola, West Africa, for instance, the whole native population eventually succumbs to respiratory affections; one rarely sees an old man (Hann). The enervating effect of warm and hot regions is evidently an important factor.

The rheumatic diseases, including valvular affections of the heart, appear to be more frequent in cold climates; the same is possibly true of nephritis, but we have, at present, no means of verifying this belief. In the case of the last, the etiology is so complex that we cannot come to any sort of conclusion, and we must bear in mind the higher diagnostic skill of the average practitioner in temperate regions, where fewer cases are likely to escape observation.

Among infectious diseases there are a few that are so intimately associated with particular climates that

we must give them separate attention; as may be inferred from their biological relations alone they are all more or less peculiar to warm regions, or, at any rate, the warm season. In addition to infectious diseases proper, there is a group of affections dependent on vegetable toxins, which is similarly limited geographically, and from a similar cause; these diseases also call for consideration under this heading. To save space no diseases strictly confined to the tropics will be considered: we shall restrict ourselves to those that can and do at times invade the temperate zone, or are native there; those that interest us most are the insect-borne diseases in the first group, and so-called hay-fever in the second.

The Insect-borne Diseases. This group of diseases, almost limited to warm climates, is characterized by their mode of transmission through the bites of dipterous insects; and, so far as we know, the infecting organism inoculated belongs to the class Protozoa. Three of these diseases are now known to attack man, and are, with a single exception, quite thoroughly understood.

Malaria consists in an infection with protozoa, of the class Sporozoa, conveyed solely by species of the dipterous genus Anopheles. Judging from the present distribution of this disease, it is probably native to the Old World, having been brought to this hemisphere in the sixteenth and seventeenth centuries.[1] Even now, it is less uniformly distributed on this side of the Atlantic Ocean than on the other; many portions of South America, well adapted to malaria, but more or less isolated commercially from the rest of

[1] See also Howard, Mosquitoes, New York, 1901, p. 93.

the world, are still only partially or not at all infected. The only absolute barrier to the ubiquity of the anopheles, aside from the absence of stagnant pools, is a July temperature below 60 degrees. There is also a belt of relative limitation between that line and the July isothermal of 66 degrees, within which the pest is exterminated with relative ease, or tends to disappear spontaneously. Many regions within this belt have always been free from malaria, Quebec for example; others have become free, as southern England.

The protozoön of tertian fever seems to flourish at a lower temperature than the organisms respectively responsible for quartan and æstivo-autumnal fever. For the latter forms the minimum temperature seems to be 72 degrees, and in the United States they are rare north of the July isothermal of 75, whereas in southern Europe the former line is reached; cases reported north of these limits always depend on casual importation. Whereas the annual epidemic of tertian fever begins in spring, as soon as the anopheles appears, the pernicious fevers do not set in until the average temperature reaches 72 degrees, as is exquisitely shown for Rome by all the local observers. Rainfall also plays an important part, for Jilek[1] shows that a wet spring precedes a severe epidemic, evidently on account of the increased formation of puddles and marshes. The elevation required for exemption from malaria increases from north to south, the factor evidently being the summer temperature; the limit is 3,000 feet in Italy and 6,000 in Colorado. The respective July temperatures at these levels are about 66 and 70 degrees; we must note, how-

[1] Ueber das Verhalten der Malariafieber in Pola, Vienna, 1881.

ever, that in Colorado the dryness of the climate is unfavorable to the mosquitoes.

Yellow fever is caused by an organism, hitherto not identified, transmitted by mosquitoes of the genus Stegomyia, the life conditions of which are somewhat similar to those of the anopheles. It is noteworthy that these allied insects do not invariably occur together; in the city of New Orleans, for instance, the anopheles is not very common, while the stegomyia is exceedingly abundant. Howard[1] defines the northern limit of the stegomyia with considerable exactness, his line corresponding closely to the July isothermal of 78 degrees, which is also the limit of the Cotton Belt; he admits that it is difficult, under these circumstances, to account for the terrible epidemics that ravaged Philadelphia and New York a century ago; if his data are correct, a recurrence of such disasters is now impossible north of Virginia and the southern tip of Illinois. By way of contrast to malaria, yellow fever is unquestionably native to tropical America, and has hitherto not gained a permanent foothold elsewhere; it is limited in its continuance by frost, which seems absolutely fatal to the micro-organism, though the infecting insect survives the winter.

The third of these diseases, trypanosomiasis (sleeping sickness), caused by the protozoön Trypanosoma, and transmitted by the dipterous insect Glossina, need not be considered by us. The infecting insect occurs only in Africa, and the chance of this disease being brought to our shores is at present remote.

Hay-Fever. Hay-fever, as designated in this country,

[1] Op. cit. and Supplement to Public Health Report, Nov. 13, 1903.

is a misnomer; true hay-fever, caused by the pollen-toxin of grasses, occurs in May and June, and is called, in this country, rose-fever. Our so-called hay-fever is properly ragweed-fever, prevails in late summer and early fall, and is produced by the pollen-toxin of the ragweed (various species of Ambrosia) and possibly of various other compositæ (Solidago, etc.). This etiology has been brilliantly and successfully demonstrated by Dunbar,[1] who, on the basis of the modern theory of immunity, has also managed to evolve an antitoxic treatment for this affection. Britton and Brown[2] give the following distribution for the genus Ambrosia: Nova Scotia to Florida, west to British Columbia and Mexico. The time of pollination is June southward, and later northward, until October. In and near New York City the plants begin to bloom about the 20th of August, continuing more or less until the first killing frost toward the middle of October. It would seem that the plant is poorly developed and secretes little toxin along the northern and higher limits of its range, for the characteristic fever does not pass beyond the July isothermal of 66 degrees. This circumstance will be utilized in our discussion on treatment, to be taken up in a later chapter.

As with all diseases caused by toxins, predisposition plays an important rôle in hay-fever; country people seem to possess an immunity, probably antitoxic, whereas the residents of towns are liable to this affection nearly in proportion to the respective sizes of the cities. At first thought, it might be supposed that city life should confer almost complete protection against a toxin, that

[1] Berliner klinische Wochenschrift, 1903.
[2] Illustrated Flora of the U. S. and Canada, 1897.

ISOTHERMALS FOR JULY NOT REDUCED TO SEA LEVEL EASTERN UNITED STATES AND CANADA

CHART III

naturally is pre-eminently a rural product, and it is true that a visit to the suburbs is apt to start the disease when the season begins. A casual inspection of our vacant lots, however, reveals the somewhat startling fact that there is not an acre of unoccupied ground which does not produce specimens of one of the species of ambrosia. There is therefore in our cities just a sufficient production of the toxin to irritate our mucous membranes, but not enough to immunize us.

The gradual naturalization of the ambrosia in Europe will undoubtedly result in the report of more and more cases of American hay-fever from that continent; a few are already beginning to appear, and the number is quite certain to increase in time. We hear little of hay-fever from the South, but we must remember that the South contains only one very large city, which is situated at the extreme southern limit of growth of the offending plant.

The accompanying map gives the location of the July isothermals referred to in these paragraphs, and reference to it will save the detailing of a mass of perplexing numerical data.

CHAPTER II

THE CLIMATOLOGY OF TEMPERATE NORTH AMERICA

Excellent monographs, well adapted for reference, describe the climates of most European countries, as well as of remote regions like Japan, India, and the Argentine Republic; there is no recent work of this kind dealing with the climate of our continent in a comprehensive manner, supplying the physician with statistical material in a readily accessible form. As a substitute, therefore, I have found it necessary to insert a somewhat lengthy chapter on this subject here, for it seems futile to refer to climates for which accurate data are not readily obtainable.

We must introduce this subject with a brief review of the general topography of North America. This continent presents a compact mass of land, extending from the thirtieth to the seventieth parallel, widening toward the north, rapidly tapering southward into the relatively narrow Mexican Plateau. In winter the continent is practically continued to the pole by the freezing of the Arctic Ocean; to the southeast we encounter the perennial influence of the warm-water reservoir of the Gulf of Mexico. We might therefore expect a continental climate throughout the year in the center, and during the winter in the north otherwise oceanic conditions; the last, however, for reasons to be given below, occur only on the outermost edge of the mainland, and to a

limited extent; in general, the North American climate is continental to or near to the very coasts.

The main topographical feature is the immense barrier of the Cordilleran Mountain system, traversing the entire length of the continent, closely hugging the Pacific coast, and separating very sharply a narrow strip of land along that shore from the broad and uniform Atlantic slope. From British Columbia into Mexico, this mountain system broadens out into a great plateau, with a maximum breadth of a thousand miles on the fortieth parallel. This plateau, while it has, in a measure, a climate of its own, is yet more western than eastern in its general features, and the continental divide, as well for climate as for surface drainage, with a crest ranging from five to eight thousand feet in height, is near its eastern edge. The Laurentian and Appalachian (Alleghany) Mountains require but few words, for their climatic importance is slight and purely local; they are too low to deflect the air-currents materially. The Ozark Mountains in the south central region are so insignificant that they may be altogether disregarded.

The great bodies of water that surround and indent the continent, or are imbedded in it, play a very subordinate part. Only on the Pacific slope does the ocean dominate the climate, and here the coast ranges limit its influence to a very narrow strip of territory. The Atlantic Ocean affects materially only the summer climate on the east coast; in winter the prevailing west winds greatly restrict its influence, and between the 37th and 44th parallels this is largely true also in summer. The Gulf of Mexico is more important, as it supplies most of the ample rainfall of the southeastern quarter

of the continent; it also contributes to the remarkable eccentricities of the temperature in this region, unknown in such low latitudes elsewhere. The importance of Hudson Bay may be considerable, but interests us only very slightly; the Great Lakes act only on their immediate shores, but their leeward banks are materially affected by their tempering influence, as we shall see later.

The Atmospheric Pressure and Prevailing Winds. The average atmospheric pressure is necessarily in some relation to the general topography, and the direction of the lower air currents depends chiefly on the barometric conditions. In giving a concise description of these two climatic elements, the lack of reliable data limits us to that portion of the continent which lies between the fifty-third parallel and the southern boundary of the United States; fortunately, these are the regions that interest us most. We shall take up the pressure and prevailing winds according to the seasons.

In winter the dominant feature is the great area of high pressure covering nearly the whole United States, with local maxima of 30.17 inches in southern Idaho, and 30.15 in the southern Alleghanies. In the northeast we encounter the great North Atlantic depression, with 29.84 inches over eastern Newfoundland; a similar figure obtains on the Alaskan coast; between them runs a ridge of higher pressure, gradually fading away toward the general low pressure of the Arctic regions. The pressure is also relatively low over the southwestern plateau, 30.00 inches at El Paso, and is depressed to the same figure just north of the Great Lakes.

The prevailing winds are northwest, with only the

following exceptions: In the southerly parts of the Lake Region, and as far as the Ohio River, they are southwest, blowing toward the Lake depression. They are northeast in extreme southern Florida and Texas (trade winds), also locally in the southwest, blowing toward the Mexican depression. The direction in the North Pacific states is generally southeast, on account of the Alaskan "low." In all, only six states show a predominance of easterly winds at any stations; elsewhere they blow uniformly from some point between north-northwest and west-southwest.

Both the differences of pressure and the prevalence of westerly winds are less marked than might be expected over so vast a continental area, not even remotely approaching the conditions obtaining in Asia, where the pressure in January exceeds 30.60 inches near Lake Baikal, and east winds are a rarity in Manchuria and North China. It is true that east winds predominate at but few American stations, but they are quite common everywhere, save in exceptionally severe seasons. This low average barometric gradient and the resulting variability of the air currents are due to the fact that the center of this continent presents the most frequented storm track in the northern hemisphere. Every few days a storm starts from either the North Pacific or Mexican depression, to cross the United States and southern Canada at often more than railway speed, so that the high-pressure areas, that form chiefly in the upper Missouri valley, rarely endure for a week at a time.

With the advance of spring the distribution of pressure becomes more uniform. A feebly developed area of high pressure extends from Hudson Bay to the

southeastern states, nowhere exceeding 30.03 inches, and a second "high," of 30.08 inches, lies off the North California coast. The southwestern depression has become quite extensive, with a minimum of 29.82 inches in New Mexico, and there seems to be a similar less marked area in British Columbia. The North Atlantic depression has become relatively feeble, 29.92 inches over the Gulf of St. Lawrence.

The wind direction is now very irregular: generally west to northwest east of the eastern belt of high pressure, east to southeast on its west side: generally westerly over the western half of the continent, north to northeast in the greater part of the Lake Region. The pressure is apparently a little lower from about Chicago to Buffalo than either to the north or south: hence the peculiarity last mentioned.

As the maximum pressure on the Pacific Coast is off northern California, the winds are northwest southward, and southwest in Washington, Oregon, and Idaho. In southern Florida the northeast trade-winds still prevail.

In summer the main feature is a belt of low pressure in the western mountain region, with a deep minimum of 29.75 inches in Arizona. The high areas off California and in the South Atlantic states maintain almost the same intensity as in spring, but the high pressure north of Lake Erie has totally disappeared.

Southwest winds now prevail east of the Mississippi River, southeast winds continue west thereof; the only important exception is that the trade winds, deflected a little to the southward, now extend to northern Florida. On the Pacific coast the winds are everywhere nearly due west, but with the tendency north or south, that we

noted for the spring months. The predominance of these air currents is much more marked in summer than in spring, especially in California, where a persistent downward pressure gradient of 0.15 inch exists from the coast to the interior; east winds are therefore a great rarity in that section in the summer months.

The most striking feature of autumn is the West Indian depression, 29.90 inches at Havana during September and October, the hurricane season; the southwestern depression fills up rapidly, and the minimum in Arizona is 29.88 inches. Over Canada the pressure falls steadily northward, ranging from 29.94 to 29.96 inches along the fifty-third parallel. There are two high areas, one over the southern Alleghanies, of 30.10, the other in eastern Oregon, 30.08 inches. These gradually become fused together in November to form the great continental "high" of the winter months.

The autumn winds are northwest in the northeastern districts, and southwest from Tennessee to northern Ontario. West of the Mississippi they continue southeast, and from the continental divide westward the conditions are similar to those of spring. In the southeast the winds are northeasterly from the Virginia capes to Alabama, as if the trade winds had advanced northward to the 37th parallel; this is perhaps not strictly accurate, as this phenomenon does not cover the whole north temperate Atlantic in these latitudes, but seems to be peculiar to the portions near the American coast.

The West Indian hurricanes are not very numerous, only two or three coming within our field of observation in the course of a season; the very destructive ones occur about once in three years. The continental storms

are commonest from November to March. Thus the months from April to July are relatively free from severe disturbances of the atmosphere, many weeks often elapsing without a well-developed storm. As the West Indian hurricanes affect only the southeast quadrant of our continent, the remaining portions are relatively undisturbed from August to October as well; in fact, these months are the quietest of all in the central and western sections, save that October occasionally is rather unsettled in the farthest north.

It might be worth our while to devote a page or two to the elements that make up the weather in the United States and Canada; a clear exposition of their relations, which are quite simple, will make the entire subject so plain, as to render further explanation unnecessary.

The characteristic feature of North American weather, especially from November until the vernal equinox, is the frequent, rapid, and almost rhythmical succession of waves of high and low pressure; most of the latter cross the continent from ocean to ocean, but a very great number originate in the north Mexican depression. The well defined "lows" outnumber the "highs," tending to fuse together; their average speed is 32 miles per hour in the winter months, but occasionally a rate of 60 miles is maintained or exceeded for a day or two at a time; the feebler depressions of the warmer months travel far more slowly. The rate mentioned is nearly double that of the storms of western Europe, and we consequently expect the American climate to be about twice as changeable. The main storm paths are as follows: the first travels from the North Pacific depression to the Lake

Region and Newfoundland, the second from northern Mexico to the Lake Region and Newfoundland, the third, less frequent, from northern Mexico or some other part of the tropics or subtropics, to and along the Gulf Stream, also to Newfoundland.

Next to the storms, the "cold waves" accompanying the winter "highs" claim our attention. These regularly originate in the Canadian Northwest and usually travel more or less to the southeast, according to the path followed by the preceding "low." After a storm of the first type, the course of the cold wave is but little south of east, and only the northern states and Canada are much affected; after a storm of the second type, the cold wave travels down the slope toward Mexico, and is felt most severely in the Rocky Mountains and to the east thereof; after one of the third type, the "high" moves exactly southeast, with severe frosts in the lower Mississippi Valley and on the South Atlantic Coast.

As the greatest "highs" are apt to follow the deepest "lows," it is not rare in winter to observe a fall of 40 degrees or more in twenty-four hours. The reverse is less common, and equally sudden rises are infrequent, save on the eastern slope of the northern Rocky Mountains, where warm "Chinook" winds are apt to accompany a storm of the first type.

The West Indian hurricanes, nearly all of which occur between August and October, generally follow the third path; owing to the season, they are not succeeded by cold waves. The great Galveston hurricane, however, after reaching the Texas Coast, followed path number two; this happens very exceptionally.

From the above review of the storm tracks and cold

waves, we can readily understand why the climate east of the continental divide is so much more variable than that to the westward; we shall presently have occasion to demonstrate this mathematically. We are also not astonished to learn that the differences in temperature, according to latitude, are greater in the eastern half of our continent than in any other part of the globe. The irregularity of our eastern winter climate is rivaled only in Western Siberia, which lies much farther north.

Before quitting this subject entirely, we may add a few remarks on certain local winds, varying from the above generalizations. Warm descending winds are a feature of the great western river valleys. Being dynamically warmed, they raise the average temperature rather abnormally in the lower reaches; not so much in the Rio Grande, Gila and Colorado River Valleys, where they are more or less northerly, as along the Snake and middle Columbia Rivers, where they blow from the south; in all these sections, the stations on the plateaus appear relatively cold, those low down abnormally warm. In the Pacific states we have some interesting examples of deflected winds. The almost unceasing west winds that enter at the Golden Gate in summer branch off in the interior, northward in the Sacramento Valley, southward along the San Joaquin. The result is that Red Bluff has almost exactly the same July temperature as Fresno, though it lies two hundred miles farther north. In winter the west winds are less continuous, but the same effect is noted, and the January temperatures are likewise almost identical at the two stations named; we must note, however, that the wind shelter of the Sierra Nevada, north of Red Bluff, is a factor that is at least

in part responsible for this curious anomaly. The river valleys of Oregon show the same deflection, with a similar effect on the temperature; thus Roseburg has northerly winds in summer, because of the direction of the Umpqua River, and is sixteen degrees cooler in summer than Red Bluff, which lies just two hundred miles to the south. If we draw Portland into the comparison, we see that Roseburg is about four degrees cooler in July than it should be, Red Bluff about as much warmer.

For the causation of "foehn" winds, blowing from the mountains into the valleys, chiefly in the prevailing wind direction, the reader is referred to works on meteorology. Under the local name of "Chinook" winds, they are a characteristic feature in the Rocky Mountains, most marked in Alberta and Montana, but still conspicuous in eastern Wyoming and Colorado. Their chief effect is a decided relative warming of the eastern slope, most marked in winter, but also noticeable at the other seasons.

Piercingly cold gales of the "mistral" type are common on the Atlantic and Gulf Coasts, and on the western shores of the Great Lakes. On the coasts they occur everywhere from Labrador to Vera Cruz, where they are known as northers; they are always most violent and continuous when the land immediately behind the coast is hilly or mountainous, and therefore are especially trying north of New Jersey. The vicinity of New York, where the Alleghanies approach nearest to the coast, is especially subject to these winds, which are at their worst in February and March, but may occur as early as November or as late as April.

In summer certain points on the lakes are subject to lake breezes during the day, and land breezes at night;

this type of winds also prevails on the Atlantic and Gulf Coasts from April or May to September.

The mean wind velocity on our continent is as follows:

	Miles Per Hour.	
	Summer.	Winter.
Atlantic and Gulf Coasts	8–16	16–24
Atlantic Plain and Alleghanies	4– 7	7–10
Lake Region	8–10	12–14
Ohio and Mississippi Valleys	5– 8	8–12
The Great Plains	13–15	11–17
Rocky Mountains and Western Plateau	6–10	6–10
Pacific States, Interior	5– 7	5– 7
Pacific Coast	6–22	6–12

These figures are, of course, mere averages, and only specially exposed stations give the higher rates. Observe the high figures on the prairies and the coasts, but especially the high summer records on the Pacific Coast, whereas the winter months lead on the Atlantic side. We may state at once that an average exceeding ten or twelve miles an hour is apt to be unpleasantly high: such figures as 22 miles on the North California Coast, and 24 miles at Block Island, in summer and winter respectively, render these localities quite unfit for the purposes of health or recuperation, at the seasons named, for it requires a frequent recurrence of violent gales to produce so great an average.

After the above outline of the conditions that determine the general character of the North American climate, we may go on to a comparatively minute chronicle of details. I have taken special pains to give as full tables as possible, including all official records that may serve as standards, and as many of the popular resorts as possible; doubtful data have, however, been rigidly

excluded, unless it was possible to modify them to something like accuracy. It is to be regretted that many current reports are based upon a single exceptional season, and that these anomalous returns have been exploited for commercial purposes; the usual statement, for instance, that Lakewood, N. J., is ten degrees warmer than New York City in winter, is a typical and flagrant example.

TEMPERATURE

Before discussing the subject of temperature in detail, we may, with profit, devote a page or two to the study of the true value of our records. Those here given either include a complete series of observations for thirty years (1871–1900), or they are reduced to this standard by comparison, for several years, with the nearest station of long record. Hann has shown that such adapted records are quite trustworthy in the case of near-by stations. In the western United States, however, the distance may be two hundred miles or more between the standard station and the one of short record; these may therefore occasionally present an error of a degree or two in the winter months.

In accepting a thirty-year average, we must bear in mind that even this may not be absolutely true; calculation shows that the probable error, plus or minus, is:

	Winter, Degrees	Summer, Degrees	Year, Degrees
New Jersey	0.6	0.3	0.16
Illinois	0.9	0.4	0.22
Louisiana	0.6	0.2	0.13
Manitoba	1.1	0.4	0.30
Colorado	0.7	0.4	0.16
California	0.4	0.2	0.13

The absurdity of giving decimals for the winter months is obvious, and there is a $\frac{1}{3}$ chance of error even in summer; in the tables, therefore, they are quoted for the annual means only.

A circumstance that interferes seriously with thermometric comparisons, and for which we must make due allowance, is the higher temperature in large cities, as compared with suburban or rural districts. The following examples are illustrative:

	Jan.	July	Year	Minimum. Average	Minimum. Absolute	Daily Range
Baltimore (city).......	34.1	77.3	55.3	+6	−7	15.8
Washington (suburban)	33.2	76.8	54.7	+3	−15	18.0
New York City........	30.8	73.8	52.0	+2	−6	14.0
New Haven (suburban).	27.5	71.8	49.4	−3	−14	16.2

According to the difference in latitude, Washington should be 0.8 degree warmer than Baltimore, and New Haven only 1.2 cooler than New York; the larger cities are therefore 1.4 degree too warm, their minima average four degrees too high, the daily range is reduced 2.2. In the tables that follow, wherever this discrepancy is suspected, city temperatures are marked (C); to obtain suburban temperatures, about 1.5 degrees should be subtracted.

Subarctic North America. Certain portions of our continent, although well to the south of the Arctic Circle, have nevertheless a climate that must be called subarctic, in view of the absence of a true summer. This section includes southern Greenland and Labrador, for which the following data are illustrative:

	Latitude	Longitude	January	February	March	April	May	June	July	August	September	October	November	December	Year
Godthaab	64.2	51.7	14	14	17	26	35	40	44	43	37	30	24	19	28.6
Nain	56.6	61.7	–6	–5	+7	20	32	41	47	49	41	31	18	6	23.4

The winter in southern Greenland resembles that of Maine, but the summer is no warmer than the Maine October; it is somewhat warmer than the above figures back in the fjords, where the maximum temperature has reached 74 degrees. The winter is sometimes quite arctic; in other years rather mild, with frequent thaws. The mean monthly range is about 45 degrees in winter and only 25 in summer; temperatures under –20 are as rare as a summer-like warmth.

Labrador lies ten degrees to the south of Greenland, but the climate is decidedly worse, being but little warmer in summer, and very much more severe in winter. The temperature is the lowest known for the latitude, which corresponds to that of the British Isles; Nain is 43 degrees colder than Aberdeen in January, and 11 in July.

The influence of the ice drift on the climate of the Labrador coast is shown by the retardation of the summer warmth, August being warmer than July. The ordinary annual range of temperature at Nain is from 77 to –36 degrees; exceptionally 80 and –45 have been observed. Both winter and summer are very erratic, as land and sea breezes alternate with great frequency, particularly at the latter season.

Little is known of the climate of interior Labrador, but the more luxuriant vegetation points to a warmer

summer, averaging about 55 degrees in July. The average for January is probably not much lower than on the coast, say about 10 below zero.

The Maritime Provinces and Newfoundland. In and about the Gulf of St. Lawrence, the climate is intermediate between those of Labrador and our northeastern states. The summer remains remarkably cool for the latitude, and the winter is still quite raw, so that the temperature as a whole resembles that of Sweden, ten to fifteen degrees farther north. The following table will illustrate this more fully:

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
St. John's, N. F.	47.6	52.7	60	23	22	27	35	43	51	59	60	54	46	37	28	40.4
Charlottetown	46.2	63.3	40	17	18	25	35	46	57	63	64	57	47	36	25	40.8
Sydney	46.2	60.2	50	20	19	25	35	45	55	62	63	57	47	37	27	41.1
Halifax	44.6	63.6	60	22	23	29	38	48	57	63	64	57	47	37	27	42 7
Yarmouth	43.8	66.0	40	27	26	31	39	47	54	59	60	55	47	39	32	43.0
St. John, N. B.	45.3	66.1	70	19	21	29	39	47	55	60	60	55	46	36	26	41 1
Chatham	47.0	65.5	50	10	12	22	35	48	60	65	64	55	43	30	17	38.4
Father Point	48.6	68.3	30	8	10	20	33	44	53	58	57	51	39	27	15	34.6

The extremes and daily range in this district are as follows:

	Average		Absolute		Daily Range	
	Max.	Min.	Max.	Min.	January	July
St. John's	84	− 6	92	−21	17—29	51—67
Sydney	85	−15	90	−25	13—27	53—71
Halifax	89	− 8	93	−17	15—30	54—72
Yarmouth	78	+ 1	83	− 2	21—34	52—67
Chatham	92	−27	98	−33	1—19	54—76
Father Point	81	−26	87	−31	0—16	49—67

We see that steady freezing weather is the rule in winter, and that the summer days are fairly warm in the

interior of New Brunswick, but very cool at exposed coastal stations. Among the hills of New Brunswick the temperature may rise to 100 and fall below –40.

The St. Lawrence and Ottawa Valleys. In this district, forming a sort of wedge between the maritime provinces and the Lake Region, we find an extreme continental climate.

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Chicoutimi	48.4	71.1	150	2	5	17	35	49	60	65	63	53	40	24	9	35.2
Quebec	46.8	71.2	100	10	12	21	35	50	61	66	64	56	43	29	16	38.6
Montreal	45.5	73.6	90	13	15	24	40	54	65	69	67	58	45	31	18	41.6
Ottawa	45.4	75.8	330	10	12	23	39	55	65	69	67	57	43	29	16	40.4
Rockliffe	46.2	77.9	560	6	9	20	38	52	62	66	64	55	42	28	14	38.0

The extremes and daily range are as follows:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	January	July
Quebec	89	–25	96	–32	3—17	57—75
Montreal	89	–21	94	–26	7—20	61—78
Ottawa	92	–29	98	–33	2—19	59—80
Rockliffe	93	–38	100	–46	–5—18	53—80

In the Ottawa Valley, –50 degrees have been reached on exceptional occasions. At the July isothermal of 68 degrees we encounter the vanguard of the flora of the middle temperate zone, as represented by the hickory and grape-vine; elsewhere the vegetation is of the type commonly called Canadian. The intense cold of the winter at Montreal and Ottawa sets no limit to the growth of the more southerly forms, for their only requirement is a sufficient warmth in midsummer.

The North Atlantic States. From Maine to Virginia there prevails a remarkable climatic uniformity, the

differences due to latitude, elevation, and proximity to the ocean can be reckoned mathematically to within a fraction of a degree; this makes it uncommonly easy to pick out the "city temperatures" in this district, and also enables us to estimate pretty closely the temperature for a station, for which no actual observations are recorded. The table that follows is not too long when we consider that this region includes very many of our largest cities and most popular resorts.

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
New England																
Kineo, Me.	45.7	69.7	1000	11	12	21	34	48	58	63	61	54	41	28	17	37.3
Bethlehem, N. H.	44.2	71.7	1480	14	15	23	36	50	60	64	62	54	42	30	20	39.2
Northfield, Vt.	44.2	72.7	880	16	17	25	38	52	62	66	64	56	44	32	22	41.2
Eastport	44.9	67.0	80	20	22	29	38	47	55	60	61	56	47	36	27	41.5
Bar Harbor	44.3	68.2	50	20	22	29	39	50	59	64	64	59	48	36	26	43.0
Portland (C)	43.6	70.2	100	22	24	32	43	54	63	68	67	60	49	38	28	45.7
Boston (C)	42.4	71.1	120	27	28	34	45	57	66	71	69	62	52	41	31	48.6
New Haven	41.3	72.9	110	28	29	35	46	58	67	72	70	63	52	41	32	49.4
Islands																
Nantucket	41.3	70.1	20	31	31	35	43	52	61	67	68	63	54	45	36	48.8
Block Island	41.2	71.5	30	31	31	35	44	53	62	68	68	63	54	44	36	49.1
Southampton, L. I.	40.9	72.4	30	31	31	36	46	56	65	70	70	64	54	43	35	50.1
New York																
Albany (C)	42.7	73.8	100	23	24	32	46	59	69	73	71	63	51	39	29	48.2
Poughkeepsie	41.7	74.0	120	25	27	33	46	59	68	72	70	63	51	39	30	48.6
New York (C)	40.7	74.0	90	31	32	37	48	60	69	74	73	66	55	44	35	52.0
Saranac Lake	44.3	74.1	1550	14	15	23	38	51	60	64	62	55	43	31	19	39.1
Cooperstown	42.7	75.0	1300	20	21	28	41	54	63	67	65	58	46	34	25	43.5
Liberty	41.8	74.8	1470	22	23	30	42	54	64	68	66	58	47	36	27	44.7
New Jersey																
Lakewood	40.1	74.2	100	30	31	37	48	59	68	73	72	65	54	43	34	51.2
Atlantic City	39.4	74.4	50	33	34	38	47	57	66	72	72	67	56	45	36	51.9

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Eastern Pennsylvania																
Scranton	41.5	75.7	800	25	27	34	45	57	66	70	68	61	50	39	29	47.6
Harrisburg	40.3	76.9	370	29	31	37	48	60	69	73	71	64	53	42	33	50.8
Philadelphia (C)	40.0	75.2	90	32	33	39	50	62	72	76	74	67	56	45	36	53.5
Maryland and Virginia																
Baltimore (C)	39.3	76.6	90	34	36	42	53	64	73	77	75	68	57	46	38	55.3
Washington	38.9	77.0	110	33	35	42	53	64	73	77	75	68	56	44	36	54.7
Richmond (C)	37.5	77.5	140	38	40	46	57	67	75	79	77	70	60	50	42	58.4
Norfolk	36.8	76.3	90	40	43	47	56	66	75	79	77	71	61	50	43	59.0
Lynchburg	37.4	79.2	680	37	40	46	56	66	74	78	76	68	57	46	39	56.9
Wytheville	36.9	81.1	2290	33	36	42	52	61	69	72	70	64	54	43	36	52.7

The following table gives the extremes and daily range at a number of stations:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	January	July
Northfield	91	−25	98	−32	7—25	54—78
Eastport	85	−13	93	−21	14—26	53—68
Portland	93	− 9	97	−17	15—29	60—76
Boston	96	− 5	102	−13	20—34	63—80
Nantucket	84	2	89	− 4	26—37	62—73
Albany	95	−10	100	−24	16—31	63—83
New York	95	2	100	− 6	25—38	67—82
Atlantic City	92	3	96	− 7	27—40	66—78
Philadelphia	97	3	103	− 6	25—40	68—85
Washington	98	2	104	−15	25—42	68—87
Norfolk	98	13	102	3	32—48	70—88
Lynchburg	98	5	102	− 6	28—46	67—89

On Nantucket and Block Island the climate is oceanic, in the interior of Virginia quite continental; the seasons are three weeks earlier in the latter. Lynchburg is 14 degrees warmer than Nantucket in May, whereas there is practically no difference in November.

The daily variability of the temperature is as follows:

	Winter, Degrees	Spring, Degrees	Summer, Degrees	Autumn, Degrees	Year, Degrees
New Jersey	6.0	5.2	3.4	4.6	4.8
Interior New England	8.2	5.7	4.2	5.7	6.0

The latter figures are as high as any on the continent.

Inversion of temperature is not sufficiently common in the Alleghanies to affect the averages very materially, because the cold-waves rarely halt in this section for even a day or two at a time. It occurs only when the actual crest of a high-pressure area overlies the mountain belt on a quiet night, and is usually aided on such occasions by a snow covering, which favors radiation. Altogether, the winter uniformly grows colder with increased elevation. The fall of temperature in ascending may be studied conveniently by comparing the summit of Mt. Washington with Bethlehem, not far from its base:

	Elev., Feet	Jan., Degrees	Apr., Degrees	July, Degrees	Oct., Degrees	Year, Degrees
Summit	6290	5	21	47	29	25.5
Base	1480	14	36	64	42	39.2
Difference	4810	9	15	17	13	13.7
Difference per	1000	1.9	3.1	3.5	2.7	2.8

This rate prevails generally throughout the eastern mountains, and may be used to calculate the temperature for all elevated situations in this half of the continent.

In northern New York and New England the monthly range of temperature averages 70 degrees in winter, and 50 in summer; in the interior of Virginia these figures are reduced to about 60 and 40 respectively, so that the winter months, at least, are very variable throughout.

On the Middle Atlantic Coast the corresponding figures are only about 50 and 35.

The enormous difference in temperature between northern Maine and southeastern Virginia, only 800 miles apart, is plainly shown by the vegetation, which ranges from arctic types on the mountain summits of New Hampshire, through a Canadian flora in the far-northern valleys, to the live oaks and red bay trees about Norfolk. A trip from Moscow to Madrid affords a smaller climatic change than one from the lakes of Maine to Cape Henry. Thus, despite the great annual range at the individual stations, cool summers and mild winters are within quite a short distance of each other.

The Hudson River, at Albany, is regularly frozen from December 15th to March 20th, but exceptionally severe seasons may add two weeks or more at either end. Only once in more than a century has it remained open; this occurred in the abnormally mild winter of 1889–90. The freezing of the Hudson is accelerated somewhat by its sluggish current, and occurs with the first fall in temperature to near the zero mark.

The Lake Region. The climate of the Lake Region is far less uniform than that just described. Considerable subdivision is necessary properly to group the very diverse and apparently somewhat irregularly distributed variations in this section. The key to the problem lies almost entirely in the respective situation on the windward or leeward sides of the different lakes, for, in winter at least, the opposite shores have comparatively little in common, owing to the prevailing west winds at that season; we may therefore group the stations accordingly.

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Lake Ontario																
Kingston	44.2	76.5	280	17	18	25	40	54	63	68	66	59	47	35	23	42.9
Toronto	43.6	79.4	290	21	21	28	41	53	63	68	66	59	47	35	26	44.0
Oswego	43.5	76.5	300	24	25	30	42	54	64	69	68	62	51	39	30	46.5
Rochester (C)	43.2	77.7	520	24	25	30	44	56	66	70	68	62	50	38	29	46.8
Lake Erie																
Port Stanley	42.7	81.2	620	22	22	28	41	53	63	68	66	59	48	36	27	44.4
Buffalo (C)	42.9	78.9	640	25	25	30	42	55	65	70	69	62	51	39	30	47.0
Erie (C)	42.1	80.1	620	27	28	33	45	57	67	71	70	64	53	41	32	49.0
Cleveland	41.5	81.7	630	27	28	34	46	58	68	72	70	64	53	41	31	49.3
Toledo (C)	41.7	83.5	630	26	28	35	48	59	69	73	71	64	52	40	30	49.6
Southern Michigan																
Detroit (C)	42.3	83.0	630	25	27	33	46	58	68	72	70	63	51	39	29	48.4
Lake Huron																
Saugeen	44.5	81.4	630	20	20	26	39	50	60	65	64	57	46	35	26	42.3
Parry Sound	45.2	80.0	610	14	15	23	38	51	61	66	64	55	43	31	20	40.1
Port Huron	42.9	82.5	610	22	23	29	42	53	64	69	67	61	49	37	28	45.3
Alpena	45.1	83.5	610	18	18	24	37	49	60	65	64	57	46	34	24	41.3
Lake Michigan																
Grand Haven	43.1	86.2	630	24	25	31	44	54	64	69	67	61	50	38	29	46.3
Mackinaw	45.8	84.4	610	18	18	24	36	48	59	65	64	58	47	34	25	41.3
Chicago (C)	41.9	87.7	620	24	27	34	46	57	67	72	71	64	52	39	30	48.6
Milwaukee	43.0	87.9	620	20	23	31	43	54	63	69	68	61	49	35	26	45.2
Green Bay	44.5	87.9	620	14	16	25	41	55	65	70	68	59	47	32	20	42.7
Lake Superior																
Marquette	46.6	87.4	640	16	17	24	38	49	59	65	64	57	45	32	23	40.8
Duluth	46.8	92.1	640	11	15	24	38	48	58	66	65	56	45	30	18	39.5
White River	48.4	85.3	1250	−1	2	12	31	45	56	61	59	51	37	20	7	31.7
Port Arthur	48.4	89.2	640	3	6	16	33	45	56	62	60	53	40	24	12	34.2

The distribution of temperature is thus far more irregular in the Lake Region than on the Atlantic Coast; this is sufficiently evident from the above table, but is illustrated even better in the following list giving the extremes and daily range:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	January	July
Kingston....	88	−20	93	−32	9—25	60—76
Toronto.....	91	−13	98	−23	14—29	58—78
Rochester....	94	− 5	99	−14	17—31	61—79
Port Stanley.	89	−14	94	−27	15—30	59—78
Buffalo......	89	− 5	95	−14	19—31	63—78
Cleveland....	93	− 6	99	−17	21—34	64—80
Saugeen.....	89	−14	94	−30	12—28	56—74
Parry Sound.	89	−31	95	−38	5—24	56—77
Port Huron..	94	−10	99	−25	15—29	60—78
Alpena......	92	−16	98	−27	12—25	57—74
Detroit	94	− 7	101	−24	19—32	63—81
Grand Haven	88	− 6	94	−25	18—31	60—78
Chicago	95	−13	103	−23	18—31	65—80
Milwaukee...	94	−17	100	−25	14—27	61—78
Green Bay...	94	−24	99	−36	7—22	60—80
Marquette...	94	−17	108	−27	10—22	57—74
Duluth......	92	−29	99	−41	4—19	59—74
White River.	88	−52	94	−58	−14—12	48—75
Port Arthur..	89	−34	95	−40	− 7—13	52—72

The daily variability in the Lake Region is less in winter, but greater in summer, than in the Atlantic States; the lakes never freeze over, and therefore temper the former season; in summer, the alternation of land and lake breezes causes frequent and rapid fluctuations. The averages are:

Winter, Degrees	Spring, Degrees	Summer, Degrees	Autumn, Degrees	Year, Degrees
6.8	6.0	4.4	5.2	5.6

We can best appreciate the influence of these great bodies of fresh water, by following a parallel of latitude,

for example, the 43d, from west to east. In the following table all temperatures have been reduced to a 600-foot level, and all "city temperatures" corrected:

	Jan.	April	July	Oct.	Year	Average	
						Max.	Min.
Milwaukee	20	43	69	49	45.2	94	−17
Grand Haven	24	44	69	50	46.4	89	− 6
Port Huron	22	42	69	49	45.3	94	−10
Buffalo	24	41	68	50	45.7	90	− 8

The July averages are hardly at all affected, the maxima decidedly more; the January means are raised as much as four degrees by exposure to the winds from the lakes, and the minima are as much as 10 degrees milder.

Marquette is 13 degrees milder than Port Arthur in January, whereas the difference should be only about 6; the difference of the average minima is 17 degrees. Similar but smaller contrasts may be noted between Port Stanley and Cleveland, Toronto and Oswego.

The cool summer in the Upper Lake Region causes the vegetation to be of a more northerly type than we find either to the east or west. The important July isothermal of 68 degrees, which rises from southwestern Maine to the Ottawa River, dips down into central Michigan, to rise again, after reaching Wisconsin, into northern Minnesota. The moderating influence of the lakes has therefore bad as well as good sides, for certain crops cannot be successfully raised in northern Michigan, that thrive in similar latitudes in Minnesota and eastern Ontario. For our purposes, however, this climatic peculiarity is of the greatest value, since it affords a great number of cool summer resorts in latitudes that would otherwise be unpleasantly warm; but for the

lakes, the inhabitants of the central states would be obliged to travel to the Atlantic Coast for a breath of cool air in hot summers.

The Ohio Valley. The Ohio Valley is intermediate in climate between the Atlantic States and the Mississippi Valley, but nearer the latter; it differs widely from that of the Lake Region. Little description in detail is necessary, for the following table supplies all the required data:

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Pittsburg (C)	40.5	80.0	840	31	33	39	51	62	71	75	73	67	55	43	35	52.9
Parkersburg	39.3	81.5	640	32	35	41	52	63	71	75	73	66	55	44	35	53.5
Columbus	40.0	83.0	820	28	32	39	51	62	71	75	73	66	54	41	33	52.1
Cincinnati (C)	39.1	84.5	570	33	36	42	55	65	74	78	76	68	56	44	37	55.3
Louisville (C)	38.2	85.6	530	34	38	45	56	66	75	79	77	69	58	45	38	56.7
Indianapolis (C)	39.8	86.2	760	28	32	40	53	64	72	76	74	66	54	42	33	52.9

The seasons are considerably earlier inland than on the lakes; note that Columbus is five degrees warmer than Cleveland in April, and only one degree in October.

The following table gives the extremes and daily range:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	January	July
Pittsburg	97	− 4	103	−20	24—39	65—85
Columbus	97	− 7	104	−20	20—36	65—86
Cincinnati	96	− 3	105	−17	26—41	68—88
Louisville	98	− 1	107	−20	26—42	69—90
Indianapolis	96	−10	106	−25	21—36	66—86

Observe the great heat of the summer afternoons and the low minima in winter, which may fall below −30 in rural districts, lower than at most points on the lakes; Indianapolis has more severe cold than Grand Haven, 200 miles to the north.

The daily variability in the Ohio Valley is remarkably great for the semi-southerly latitude:

Winter, Degrees	Spring, Degrees	Summer, Degrees	Autumn, Degrees	Year, Degrees
7.1	5.4	3.2	4.9	5.2

The rise of temperature from Moose Factory on James Bay to Parkersburg, 800 miles to the south, is the most rapid in the world for the distance; for each degree of latitude it amounts to 3.2 degrees in January, 1.3 in July, and 2.1 for the year. The total equals that between the North Cape and Naples, which are 2,000 miles apart, 30 degrees in latitude as compared with 12.

The Upper South. The most natural division between the upper and lower South is marked by the vegetation. In the upper South the forest growth is similar to that of Ohio and Virginia, being composed almost entirely of deciduous hard woods, only in somewhat greater variety; in the lower South we have vast forests of long-leaved pine, intermingled with a few broad-leaved deciduous and evergreen trees; toward the coasts the broad-leaved evergreens gradually become more conspicuous, and the characteristic plants are the live oak and palmetto. The dividing line runs from Cape Henry, at first near the coast, then inward to central South Carolina and Georgia, dropping almost to the 32d parallel in Alabama, Mississippi and Louisiana. We therefore expect to find, in the upper South, a climate similar to that of the Ohio Valley, only of course warmer, in proportion to the difference in latitude; we shall see that the extremes are relatively much the same in both districts.

I give the following table:

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Nashville (C)	36.2	86.8	550	38	42	49	60	68	76	80	78	71	60	48	42	59.3
Knoxville	35.8	83.8	1000	38	42	48	57	66	73	76	74	67	58	47	40	57.2
Raleigh	35.8	78.6	380	40	44	49	58	67	75	78	76	70	60	49	43	59.1
Asheville	35.5	82.5	2250	37	41	46	54	62	69	72	70	64	55	46	39	54.6
Charlotte	35.2	80.7	770	41	45	51	60	68	75	78	76	70	61	50	44	59.9
Memphis	35.1	90.1	340	41	45	52	62	70	78	81	79	72	62	50	44	61.3
Little Rock	34.8	92.3	360	42	46	52	62	70	77	80	79	72	62	51	45	61.5
Atlanta	33.8	84.4	1110	43	47	53	62	69	75	78	77	71	63	53	46	61.4

The following table gives the extremes and daily range:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	January	July
Nashville	97	+3	104	−13	30—47	70—90
Knoxville	96	+3	100	−16	29—48	65—87
Charlotte	98	+9	102	− 5	32—51	68—88
Memphis	98	+8	104	− 9	33—49	72—91
Atlanta	96	+9	100	− 8	35—52	69—87

In January the days nowhere average really mild, and the nights range mostly about the freezing point; the summer days are uniformly hot. The extreme minima are phenomenally low for the latitude, corresponding to that of Algeria, and the absence of subtropical vegetation is thus easily accounted for; the daily variability is also excessive, at least in winter.

Winter, Degrees	Spring, Degrees	Summer, Degrees	Autumn, Degrees	Year, Degrees
6.5	4.9	2.6	4.3	4.6

Even Atlanta has less than eight months relatively free from killing frosts, and the entire region is sure to

prove disappointing to such as seek a really mild winter climate. That season is, indeed, rather trying, for spring days alternate with zero weather, such monthly ranges as 75 degrees being far from uncommon. The summer in the lowlands is nearly as hot as in the extreme south, only shorter; the finest months are March, April, October and November, above 1,500 feet also May and September; but only southerners would call the summer at such places as Asheville comfortably cool, for its mean temperature is higher than that of Boston or Chicago, the nights being somewhat cooler, the days considerably warmer.

The Lower South. This section is much milder in winter, the conditions becoming those of the warm temperate zone. Two subdivisions may be distinguished by their characteristic vegetation, namely, the pine and palmetto belts; in the former the subtropical flora is only partially developed, for the winter minimum still regularly falls to about 15 degrees, and occasionally to zero.

The Pine Belt

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Augusta	33.5	81 9	180	47	50	56	64	72	78	81	79	74	64	54	48	63 9
Montgomery	32.4	86.3	220	48	52	58	66	73	79	81	80	75	65	55	50	65.2
Vicksburg	32.4	90.6	250	48	53	59	66	73	79	81	80	75	65	55	50	65 3

The Palmetto Belt

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Hatteras	35.2	75.5	20	46	47	50	57	65	73	77	77	74	65	56	48	61.3
Wilmington	34.2	78.0	80	47	50	54	62	70	77	80	78	73	64	54	48	63.1
Charleston	32.8	79.9	50	50	53	57	65	72	79	82	80	76	67	58	51	65.8
Savannah	32 1	81.1	70	51	54	59	66	73	79	82	80	76	67	58	52	66 4
Jacksonville	30 3	81 6	40	55	58	62	69	75	80	82	81	78	70	62	56	69 0
Mobile	30 7	88.0	60	51	54	59	67	74	79	81	80	77	68	58	52	66.7
New Orleans (C)	30.0	90.1	50	54	57	62	69	75	80	82	81	78	70	62	56	68.8

The following figures will give an idea of the extremes and daily range in this region:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	January	July
Augusta	100	+16	105	+ 3	37—57	71—91
Montgomery	99	+16	107	− 5	38—58	71—91
Vicksburg	98	+16	101	− 1	39—57	72—90
Hatteras	89	+18	92	+ 8	41—52	73—82
Wilmington	97	+17	103	+ 5	38—56	73—88
Charleston	98	+20	104	+ 7	43—58	76—88
Jacksonville	98	+24	104	+10	46—65	74—90
Mobile	98	+20	102	− 1	43—60	73—89
New Orleans	95	+25	102	+ 7	47—62	75—90

The winter days average mild throughout, but these figures are most deceptive, for the extreme minima present a very different picture; the combination of generally spring-like conditions with occasional frosts of great severity makes the southern winter rather dangerous as well as trying. Even in New Orleans the temperature fell below the freezing point in 24 winters out of 30; the minimum of −1 at Mobile in February 1899, is one of the most remarkable events in the history of that city; in the pine belt zero weather occurs about once in a decade.

The variability of the temperature is as great, in winter, in Georgia as in New Jersey, but the summer is much steadier; the average figures for the lower south are:

Winter, Degrees	Spring, Degrees	Summer, Degrees	Autumn, Degrees	Year, Degrees
5.8	3.9	2.0	3.6	3.8

The remarkable eccentricity of the southeastern winter, unique in so low a latitude, is due to a moderate number of cold waves, accompanying the descent of a high-

pressure area from Montana to Texas, in the wake of a storm crossing the Gulf States. The "high" travels south in 24 to 36 hours, causing a severe "norther" in Oklahoma and Texas, followed within another 24 hours by severe frost as far south as central and even southern Florida.

The very severe spells occur at long intervals; the temperature has gone as low as 20 degrees at Jacksonville on seven occasions in thirty years; no severe freeze occurred in the eight winters from 1887 to 1894, but two took place in the subsequent season, ruining the citrus-fruit industry for years to follow.

Florida. The peninsula of Florida marks the transition from the temperate zone to the tropics. The vegetation of the latter, having made only the feeblest beginning in extreme southeastern Georgia, becomes dominant south of Titusville and Tampa, though the tenderest types cannot withstand the occasional sharp frosts of even the southern end of the peninsula, and are found only on the outermost keys.

The temperature at various points is as follows:

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Tampa	28 0	82.5	30	60	62	65	71	76	80	82	82	80	74	66	61	71 6
Jupiter	27.0	80.0	30	65	66	68	71	75	79	81	81	79	75	70	65	72.9
Key West (C)	24 6	81 8	30	70	71	73	76	79	82	84	84	82	79	74	70	77.1

The extremes and daily range are:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	January	July
Tampa	94	+30	96	+19	50—70	74—91
Jupiter	93	+36	96	+24	58—72	76—87
Key West	91	+50	94	+41	66—75	80—88

Killing frost occurs in three winters out of four at Tampa, and in one out of three at Jupiter; it is unknown at Key West. From May to October the climate is about as enervating as can be imagined. The reader will have observed that, from Cape Hatteras southward, the daily range is greater in winter than in summer; this is due to the change in direction of the prevailing winds, outlined at the commencement of this chapter. The South Atlantic Coast has, in fact, a well-developed monsoon system of winds, which is associated, as we shall see, with corresponding peculiarities in the seasonal distribution of humidity and rainfall; the land winds, that prevail from November to April, give way to sea winds during the warmer months. North of Norfolk west winds predominate throughout the year, south of Jupiter the northeast trade winds blow perennially; the northward movement of the latter begins in April, progresses slowly until the northern limit is reached late in August, is followed by a stationary period until late October, and a rapid retreat during November. They do not in any case extend beyond the foothills of the Alleghanies or west of Alabama.

The rise of temperature, from Parkersburg to Key West, for each degree of latitude, is 2.5 degrees in January, 0.3 in July, and 1.4 for the year, therefore much less than in the north, especially in summer, but still considerable for the warm temperate zone.

Before quitting the southeastern regions, we must take a passing glance at certain insular localities, that belong, in a measure, to this section.

The Bermudas and Bahamas. These groups of small

islands are of no little interest to the medical climatologist, and merit considerable attention. We have the following data from the Bermudas:

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Hamilton	32.4	64.7	50	62	61	62	64	69	74	78	79	77	73	68	64	69.3

Though opposite Charleston, the winter is very much warmer, the summer but a trifle cooler, the usual range of temperature is from 90 to 48 degrees; frost is extremely rare, as are temperatures above 92. The course of the seasons is oceanic, midwinter falls as late as the middle of February, and midsummer well on in August; the uncomfortable heat lasts until late October, whereas May is still very tolerable.

Our data from the Bahamas are scanty; the temperature at Nassau averages 71 degrees in January, and 82 in July and August, with an annual mean of 76.5; the chief difference from Miami, Fla., directly opposite, is a somewhat warmer winter, with the total absence of frost.

Cuba is outside of our field, but as Havana lies only twenty miles within the tropics, I give a set of figures for the sake of comparison.

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Havana	23.1	82.4	60	71	72	73	75	78	80	81	81	80	77	74	71	76.1

The relatively cool summer is due to the exposure of the city to the northeast trade winds. The lowest

temperature in a fairly long series of observations was 49 degrees, the mean minimum being 55 degrees, a temperature felt severely in this enervating climate. The average maximum in summer is 94 degrees.

The Mississippi Valley, etc. We may begin our study of the middle and upper Mississippi Valley, and the regions lying to the north and west, as far as the 100th meridian, with a list of tabulated data. The outlying sections have been entered here because their type of climate is precisely similar.

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Cairo	37.0	89.2	360	35	39	47	59	67	75	79	77	70	59	46	39	57.7
St. Louis (C)	38.6	90.3	470	31	36	43	56	66	75	79	77	70	58	44	36	55.9
Kansas City	39.1	94.6	960	26	32	40	54	64	73	77	75	68	56	41	32	53.2
Des Moines	41.6	93.6	860	18	23	34	50	61	71	75	73	64	51	36	26	48.5
La Crosse (C)	43.8	91.2	710	15	20	31	47	59	69	73	71	62	49	33	23	46.0
St. Paul (C)	45.0	93.0	840	11	16	28	45	57	67	71	69	60	47	30	19	43.3
Moorhead	46.8	96.8	940	0	5	20	41	53	64	68	66	57	43	24	10	37.6
Wichita	37.7	97.4	1360	29	35	43	56	65	73	78	75	67	57	43	35	54.7
Omaha	41.3	96.0	1100	19	25	35	51	62	71	76	74	65	53	37	27	49.6
Huron, S. D.	44.4	98.2	1310	9	14	26	44	57	67	71	69	59	46	29	17	42.3
Winnipeg	49.9	97.1	770	−7	−2	13	36	52	62	66	64	52	39	17	3	32.9

The extremes and daily range in this region are as follows:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	January	July
Cairo	96	0	106	−16	28—43	70—88
St. Louis	98	− 5	107	−22	24—38	70—89
Kansas City	100	−11	106	−22	19—34	67—88
Des Moines	98	−19	109	−30	10—26	64—86
La Crosse	95	−25	104	−43	8—23	62—84
St. Paul	95	−27	104	−41	4—19	61—82
Moorhead	96	−35	102	−48	−9—+ 9	56—80
Wichita	101	− 5	106	−22	20—38	66—90
Omaha	100	−18	106	−32	11—27	66—87
Huron	101	−30	108	−43	− 1—+19	58—84
Winnipeg	93	−43	103	−54	−17—+ 4	53—79

In February 1899 −63 degrees were observed at Norway House in latitude 54; within a few days −29 were recorded at Springfield, Mo., and −1 at Mobile, Ala.

In Manitoba, frost is common in early June, and not very rare in the latter part of August. North of latitude 45, the January nights regularly have temperatures below zero, but occasional brief spells of thawing weather may occur in midwinter at Winnipeg and beyond.

The weather is exceedingly changeable everywhere, and nearly as much so in Missouri as in Manitoba, the average variability being:

Winter, Degrees	Spring, Degrees	Summer, Degrees	Autumn, Degrees	Year, Degrees
8.3	5.8	3.8	5.6	5.9

At Winnipeg the mean monthly range is 72 degrees in January and 47 in July, and at St. Louis the corresponding figures are only about eight degrees less.

The South Central States have the same type of climate, only warmer.

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Oklahoma	35 4	97 5	1210	36	41	49	60	68	75	79	77	70	60	48	41	58 7
Shreveport	32 5	93 6	250	46	51	58	66	73	80	83	81	75	65	55	49	65 2
Galveston (C)	29 3	94 8	50	53	57	63	70	76	82	84	83	79	72	63	56	69.8
San Antonio	29.4	98.5	700	51	56	62	70	76	81	83	82	77	70	60	54	68.5
Corpus Christi	27.8	97.5	20	56	59	64	70	76	80	82	81	79	72	64	58	70.1

The extremes and daily range are:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	Jan.	July
Oklahoma	100	− 1	104	−17	26—46	68—90
Shreveport	101	+15	107	− 5	37—55	73—94
Galveston	94	+25	98	+ 8	48—58	80—89
San Antonio	102	+18	108	+ 4	41—62	73—94
Corpus Christi	95	+25	98	+11	50—62	77—87

All the absolute minima date from February 1899, when the thermometer fell to 31 degrees at Tuxpan, Mexico, in latitude 21, the farthest recorded southward extension of the frost line on our continent, at the sea level.

Along the 98th meridian, the rise of temperature for each degree of latitude is as follows:

	January, Degrees	July, Degrees	Year, Degrees
Winnipeg to Wichita	3.0	1.2	1.9
Wichita to Corpus Christi	2.2	0.0	1.2

It will be seen that these figures are somewhat smaller than those given for the 81st meridian on pages 68 and 74.

The mean variability of temperature in the South Central States is:

	Winter, Degrees	Spring, Degrees	Summer, Degrees	Autumn, Degrees	Year, Degrees
Oklahoma	6.3	4.4	2.3	4.0	4.3
Texas Coast	5.1	2.6	1.3	3.2	3.0

The Texas Coast would enjoy a most even climate but for the occasional cold snaps (northers) which bring killing frost nearly every winter to the Rio Grande and beyond. The subtropical flora, as the minimum temperatures at Shreveport would suggest, barely reaches the 32d parallel in Texas, and tender plants, such as the Magnolia grandiflora, endure the winter better at Richmond, Va., than at Fort Worth, five degrees farther south. Westward the subtropical vegetation gradually assumes the character of the so-called chaparral, consisting of partly evergreen thickets of live oak, mesquite

and aromatic shrubs, resembling the *macchie* of the Mediterranean region; this floral type characterizes the semi-arid subtropical regions of both hemispheres. On the lower Rio Grande we find the beginnings of the tropical flora of the Mexican lowlands, despite occasional freezing weather; it will be remembered that analogous conditions appear in Florida, only there the somewhat milder winter permits an extension a few degrees farther north.

The Great Plains and the Rocky Mountain Slope. The Great Plains, while apparently level, nevertheless rise gradually westward, about four feet to the mile on the 50th, and eight on the 40th parallel. Slight as is this slope, it seems to be intimately connected with the climatic peculiarities of this region, which consist essentially in a rise of temperature, as we ascend. Thus, in Canada, Medicine Hat is 14 degrees warmer than Winnipeg in winter, and 1 in summer, although it lies 1,400 feet higher; similarly, Cheyenne is 6 degrees warmer than Omaha in winter, although its elevation is 5,000 feet higher; its summer, while cooler, is far less so than the difference in altitude would call for, averaging only 9 degrees lower, instead of at least 15. Near the mountains, this may, of course, be attributed to "foehn" winds, but the increase is so gradual, beginning as far east as the 96th meridian, that the above explanation does not cover the ground perfectly; we cannot see, for example, why the winter at North Platte, in the midst of the plains, should also be warmer than at Omaha, in spite of a rise of 1,700 feet.

The following table gives the temperature data for this region:

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Abilene, Tex.	32.4	99.8	1,740	41	46	54	64	72	79	82	80	73	64	52	45	62.7
Amarillo	35.2	101.7	3,680	30	35	44	55	64	72	76	74	66	56	43	35	54.2
Dodge City	37.7	100.0	2,510	26	32	41	54	64	73	78	75	67	55	40	32	53.1
Denver	39.8	105.0	5,290	28	32	39	47	56	66	72	70	62	50	38	32	49.3
North Platte	41.1	100.7	2,820	20	26	35	49	59	68	73	71	62	50	35	26	47.8
Cheyenne	41.1	104.8	6,090	25	27	33	41	51	61	67	65	56	45	34	28	44.4
Lander	42.8	108.6	5,370	16	21	30	40	50	60	66	64	55	44	31	23	41.7
Rapid City	44.1	103.2	3,230	19	23	32	45	55	64	70	68	59	48	35	26	45.3
Pierre	44.4	100.3	1,570	12	17	29	46	58	69	74	71	61	48	31	20	44.7
Yellowstone Park	44.8	110.5	6,200	17	20	26	34	44	54	60	58	50	41	30	23	38.1
Helena	46.6	112.1	4,110	17	22	33	44	52	60	67	66	56	44	32	24	43.1
Bismarck	46.8	100.8	1,670	5	10	23	42	54	64	69	67	57	44	26	14	39.6
Williston	48.2	103.6	1,880	3	8	22	41	53	63	68	66	56	42	24	12	38.2
Havre	48.6	109.7	2 500	10	15	28	43	52	61	67	65	55	43	28	18	40.4
Medicine Hat	50.0	110.6	2,160	7	12	26	44	54	62	68	66	56	44	27	15	40.1
Regina	50.4	104.6	1,880	−6	−1	15	37	50	60	64	62	51	38	17	3	32.5
Banff	51.2	115.6	4,540	9	13	24	36	45	52	56	54	46	37	26	17	34.6
Prince Albert	53.2	106.0	1,430	−8	−3	12	34	48	58	62	60	49	36	14	2	30.5
Edmonton	53.2	113.5	2,160	3	8	24	40	50	57	61	59	50	40	26	12	35.7

The prairies extend only as far north as the Saskatchewan, farther on we enter the great subarctic forest which extends northwestward almost to the mouth of the Mackenzie River. The extremes and daily range on the Great Plains are as follows:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	Jan.	July
Abilene	102	+ 6	110	− 6	31—52	71—93
Amarillo	97	− 4	105	−16	19—42	64—88
Dodge City	102	−12	108	−26	14—38	65—91
North Platte	100	−20	107	−35	8—32	60—87
Denver	97	−14	105	−29	16—40	58—87
Cheyenne	94	−19	100	−38	15−36	53—81
Rapid City	100	−24	106	−40	8—30	58—83
Pierre	105	−25	113	−40	2—23	62—86
Helena	95	−26	103	−42	10—25	56—79
Bismarck	100	−34	106	−44	−5—+16	57—81
Havre	99	−36	108	−55	0—21	54—81
Regina	98	−49	—	—	−16—+ 4	50—78
Edmonton	88	−46	92	−57	− 6—+12	49—73
Prince Albert	92	−54	96	−70	−17—+ 1	50—75

The reader will note the relatively warm days and cold nights. In January, Denver has the day temperature of Baltimore and the night temperature of Albany; in July we find the days as hot as at Washington and the nights as cool as at Quebec, the heat of the day being tempered by a phenomenally low humidity.

The winter minima are astonishingly low. In January, 1885, −63 degrees were registered at Poplar River, in northeastern Montana, and in February, 1893, there was a record of −70 at Prince Albert. There is no doubt that figures as low as −75 and −80 occur in far northwestern Canada, where −65 is quite frequent.

The different seasons vary exceedingly from the normal temperature; thus, at Edmonton, within fifteen years, the average for November has been as high as 40 degrees and as low as zero; for January, the figures for the same period are 22 and −13. At Winnipeg, February has averaged 24 (1878) and −16 (1875) degrees; similar climatic eccentricities have been repeatedly noted at Havre and other points at the foot of the Rockies. A succession of the winter storms of the first type, passing through the Canadian Northwest, causes frequent Chinook winds and a high mean; the stagnation of high-pressure areas over this region, which is less frequent, produces the intense cold noted above. Changes of 30 degrees in an hour when the wind shifts from southwest to north, and vice versa, are not at all rare on the mountain slopes, even so far south as western Texas; Greeley reports a rise of 47 degrees in 8 hours at Denver, and for Abilene there is on record a fall of 63 degrees in 16

hours. The mean monthly range at Williston is 74 degrees in winter, and 57 in summer.

The daily variability for this region is quite uniformly:

Winter, Degrees	Spring, Degrees	Summer, Degrees	Autumn, Degrees	Year, Degrees
7.5	5.8	3.6	5.4	5.6

In winter there is little difference between Montana and Texas, but the summer is much steadier southward.

Before leaving the Great Plains, we may glance briefly at the distribution of a few of their more striking meteorological phenomena. Among these, the tornado easily ranks foremost, but is not altogether peculiar to this portion of the continent, being, in fact, rather uncommon west of the 100th meridian, and diminishing in force and frequency only gradually as the Atlantic Coast is approached. Tornadoes are commonest in Missouri, Kansas, Iowa and Nebraska; then follow Illinois, the lower Mississippi Valley, Oklahoma and Texas; finally, the Ohio Valley, southern Minnesota and South Dakota. In the Atlantic States they are much less frequent and destructive.

Hot winds are not so frequent as is often supposed, and only exceptionally, as in the unusually dry and hot July of 1901, reach so far east as the Mississippi River. Toward the Rocky Mountains they become common, but even here are rarely so hot and dry as in Arizona, California, and the Snake River Valley. Temperatures above 105 degrees are quite rare, save at such localities as Pierre, which is situated to the north of a plateau,

where the south winds, already warm, are still further heated and dried dynamically in descending.

The third specialty of the Plains is the blizzard. It has recently become the fashion to call every violent snowstorm a blizzard, but the true blizzard, with fine dust-like snow, a fierce gale, and a temperature rapidly falling to zero and below is almost entirely confined to this region, prevailing in the Dakotas, Montana, Nebraska and the eastern halves of Wyoming and Colorado, less often Kansas. In the far north, it attracts less attention, chiefly perhaps because the inhabitants are pretty thoroughly accustomed to severe weather. The heavy snowstorms east of Nebraska and the Dakotas hardly partake of the irresistibly fatal character of the true blizzard.

For a more minute description of the above phenomena, the reader is referred to works on meteorology; it would be out of place in a book of this kind.

We have now completed our survey of the temperature conditions east of the continental divide, and may begin the consideration of the West with

The Western Plateau. Our knowledge of this region is less complete than might be desired, good records being absolutely wanting north of the 53d parallel, and scattered and scanty elsewhere, especially in the less settled districts. The southwestern plateau is excluded from consideration here, its climate differing from the region north of the 37th parallel in many respects. The following averages have been corrected as carefully as possible by comparison with the long-established ones, which number only about eight, even if a few just outside of the district are included:

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Carson City	39.2	119.8	4720	31	35	40	47	54	61	67	66	59	50	40	34	48.7
Salt Lake City	40.7	111.9	4370	28	34	42	50	58	67	75	74	64	52	40	32	51.3
Winnemucca	41.1	117.7	4340	27	33	40	47	55	63	71	70	60	49	37	31	48.6
Leadville	39.3	103.3	10220	9	13	20	28	37	45	52	50	42	32	20	14	30.2
Grand Junction	39.1	108.6	4610	24	30	41	52	63	71	78	76	65	52	37	29	51.5
Durango	37.2	107.9	6550	24	28	36	45	54	61	67	66	58	47	34	28	45.7
Pocatello	42.9	112.5	4480	24	30	38	46	54	63	71	70	59	47	35	27	47.0
Boisé City	43.6	116.2	2740	29	35	43	51	59	66	73	71	61	50	38	32	50.7
Baker City	44.8	117.8	3470	21	27	35	44	52	59	65	64	56	46	35	26	44.2
Walla Walla	46.1	118.3	1000	30	35	44	53	61	67	73	72	64	54	42	35	52.5
Spokane	47.7	117.4	1940	24	30	39	48	57	63	69	68	59	49	38	30	47.8
Kalispell	48.2	114.4	2960	17	22	32	42	52	58	64	63	54	44	31	24	41.9
Kamloops	50.7	120.5	1190	23	29	38	48	57	64	69	68	58	48	35	28	47.1
Barkerville	53.0	121.9	4180	17	20	26	34	43	51	56	55	47	38	26	21	36.2

The relatively high temperature of this region will be best appreciated by reference to maps of isothermal lines; it will be noticed, however, that the winter at first grows somewhat colder, when we cross the continental divide, so that western Colorado and Wyoming, also eastern Idaho and adjoining Montana are colder than the regions on either side. The distribution of temperature is in any case less uniform than on the eastern side of the continent, and there are many local warm and cold climatic islands, according to the situation of the individual localities. In western Colorado it is of interest to note the rapidly increasing heat in summer from Durango to Grand Junction, due to descending air currents from the southeast. The following records afford an idea of the extremes and daily range of temperature:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	Jan.	July
Carson City	94	− 5	100	−22	19—43	51—83
Salt Lake City	98	− 3	102	−20	21—36	62—88
Winnemucca	97	−10	104	−28	17—37	55—88
Boisé City	104	− 6	111	−28	22—37	58—89
Walla Walla	104	− 4	113	−17	24—36	60—86
Spokane	99	−12	104	−30	18—30	56—82

The most marked difference between the two slopes of the Rocky Mountains is in the variability of the temperature, which is less than two-thirds as great in winter on the west as on the east side; the following figures prevail quite uniformly throughout:

Winter, Degrees	Spring, Degrees	Summer Degrees	Autumn, Degrees	Year, Degrees
4.5	4.0	3.3	3.9	3.9

It is therefore all the more surprising to note the occasional intense cold at stations so mild as Salt Lake City and Walla Walla, not to speak of −28 degrees at Boisé City. These cold waves are very exceptional, and the usual minima barely touch zero; they are due to the very uncommon stagnation of a high-pressure area over the northern plateau, while the Great Basin itself is snow covered. The same phenomenon occurs in Central Europe under analogous conditions.

The daily range in winter is relatively small, as this is the rainy season west of the divide: in summer the range is enormous, the nights are cool and the days very hot, this season being almost rainless.

As we ascend the mountains, the fall in temperature is very rapid, as seen on Pike's Peak, for example.

	Elev., Feet	Jan., Degrees	April, Degrees	July, Degrees	Oct., Degrees	Year, Degrees
Summit..........	14130	3	13	39	22	19.2
Colorado Springs...	6060	27	46	70	48	47.8
Difference.........	8070	24	33	31	26	28.6
" per......	1000	3.0	4.1	3.8	3.2	3.5

We see how greatly this rate exceeds that in the Alleghanies; it is, however, very much less on the

western slope of the Rockies, at least in winter, when inversion of temperature is quite frequent on that side. The tree line is remarkably high for the latitude in Colorado, 11,500 feet; the snow line is touched only by the highest peaks, and there are no glaciers of any consequence south of the Canadian border, until we approach the Pacific Coast.

The Southwest. Extreme southern Utah and Colorado, with the adjoining portions of Arizona and New Mexico, form a vast high plateau, deeply grooved by the cañon of the Colorado. Passing southward from this tableland we enter a region geographically, as before 1846 also politically, belonging to Mexico. This relation is shown by both the flora and the climate; as we descend, the temperature rises very rapidly, and the distribution of moisture, as we shall see later, becomes quite different from that prevailing farther north, east, and west.

The Upper Rio Grande Valley and Arizona first claim our attention, and the following table will supply sufficient and reliable data as to the temperature:

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Santa Fe	35.7	106.0	7010	28	32	39	47	56	65	68	66	60	50	38	31	48.3
El Paso	31.8	106.5	3760	44	49	56	64	73	80	82	79	73	63	52	46	63.4
Prescott	34.5	112.5	5390	32	36	43	51	59	67	73	71	63	54	42	35	52.2
Phœnix	33.5	112.0	1110	50	54	60	67	75	83	90	88	81	70	59	52	69.1

The climate of the Mexican plateau is so similar that we may most conveniently refer to it here; Mexico City, though situated in the tropics, is rendered temperate by the altitude, and may therefore likewise be added.

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Chihuahua	28.6	106.5	5400	50	54	61	69	76	79	79	73	71	65	57	52	65.5
Saltillo	25.6	100.5	4670	51	54	60	66	71	75	71	71	69	63	56	51	63.2
Mexico City	19.4	99.1	7470	54	57	60	64	65	64	62	62	61	59	56	54	59.7

At El Paso, August is cooler than June, south of Chihuahua July also becomes cooler, and in central Mexico May becomes the warmest month. This shifting of the period of greatest heat is connected with the development of the rainy season.

The following table gives an idea of the extremes and daily range:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	Jan.	July
Santa Fe	90	− 2	97	−13	18—38	57— 79
El Paso	102	+11	108	− 5	31—58	69— 95
Prescott	95	+ 1	100	−18	20—45	58— 89
Phœnix	113	+24	119	+12	37—64	76—105
Mexico City	85	+33	—	—	41—67	May 52— 78

The summer days are hot, but in the upland sections the nights are always comfortably cool; in the lowlands high temperatures prevail both day and night. The winter weather resembles that in the Great Basin, but is drier and has a greater daily range, with of course also a rapid rise of the average temperature as we go south and descend into the deeper valleys of the Gila and Rio Grande rivers.

The daily variability is quite small, as follows:

Winter, Degrees	Spring, Degrees	Summer, Degrees	Autumn, Degrees	Year, Degrees
4.0	3.8	2.4	3.1	3.3

In the low valleys the summer temperature is very steady, with a maximum around or above 100 degrees every day for months.

The lower Gila Valley marks the transition to the deserts of southeastern California; for the latter section we have official records for Yuma and Independence. I have corrected the semi-official data for Salton to the Yuma standard, and the resulting figures are at least approximately correct; while apparently altogether too high in summer, they agree very closely with the results obtained by the U. S. Government's Death Valley expedition.

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Yuma	32 6	114.6	140	54	58	64	70	77	85	92	91	84	73	62	56	72.2
Salton	33.5	115.9	−250	52	57	65	75	85	95	102	100	92	80	67	58	77.3
Independence	36.8	118.2	3910	40	44	50	57	65	73	80	78	70	60	48	43	59.0

In the depression at Salton, the summer is the hottest known in the world; 128 degrees have been recorded and 120 occur for days at a time. Death Valley averages only about two degrees cooler at all seasons; at Yuma the ordinary extremes are 114 and 28 degrees, the absolute extremes 118 and 20, the daily range is from 41 to 68 in January, and from 77 to 108 in July, when the afternoon maximum almost invariably exceeds 100.

Salton is only ninety miles from the coast, where the July temperature is 35 degrees lower; this is the greatest contrast of temperature known, but the transition is not very uniform, being gradual and moderate

from the coast to the Coast Range of mountains, on the east side of which the increase of heat is very sudden.

On the west coast of Mexico we have trustworthy figures only from Mazatlan, just within the tropics.

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Mazatlan	23.2	106.4	30	68	68	70	73	77	81	83	84	84	81	76	71	76.3

Topolobampo, in latitude 25° 3′, averages about 64 degrees in January, and 86 in August; Guaymas, in latitude 28°, about 60 in January and 90 in August.

The interior of Sonora resembles southern Arizona, but is a little warmer in winter. No part of northwestern Mexico has as yet advanced sufficiently in civilization to attract the health-seeker and ordinary tourist.

The Pacific Coast. We may begin our consideration of the climate of the Pacific Coast with southwestern California. As mentioned above, this section presents a most striking contrast to the desert behind the Coast Range. The temperatures for southwestern California are:

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
San Diego	32.7	117.2	90	54	55	56	58	61	64	67	69	67	63	59	56	60.7
Santa Catalina Island	33.4	118.4	50	54	54	55	56	57	59	60	61	60	59	57	55	57.2
Los Angeles	34.1	118.2	340	53	55	57	59	62	66	69	70	68	64	59	55	61.4
Santa Barbara	34.4	119.7	130	53	54	55	56	59	62	64	66	64	61	58	55	58.9
Monterey	36.6	122.0	100	50	51	52	54	56	58	60	61	60	57	54	52	55.4

August is everywhere the warmest month, and September is often as warm as July. Owing to the hilly character of the country, the sea breeze does not

penetrate freely into the interior, and we find there an increased warmth in spite of a considerable elevation. On the other hand, the hot winds, in a modified form, sometimes reach the coast itself, as shown in the following table of extremes:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	Jan.	July
San Diego........	90	+37	101	+32	46—62	63—72
Los Angeles......	100	+33	109	+28	43—64	58—81

The outer islands are, however, entirely exempt from very warm weather; they enjoy an eternal spring, in winter they resemble early May in New York, in summer the latter part of May, of course in temperature only. Toward the middle Californian region, the climate also becomes singularly even, as at Monterey, where we find a transition to the San Francisco district.

Lower California seems to have a uniform climate in winter, January averaging about 55 degrees in the north, and 65 in the extreme south; in summer the west coast is cool, ranging from about 70 degrees in the north to 75 in the south, but the east coast grows very hot toward the head of the Gulf of California, with a July average of 90 degrees. All these figures are, of course, mere estimates, as no accurate records are extant.

As a striking contrast to the coast and deserts just described, we may note the rather severe mountain climate in the Sierra Nevada. At Lake Tahoe, 6,200 feet high, January averages about 26 degrees and July 62, with annual extremes of about 90 and −15. Frost is not very rare in midsummer; nevertheless, in warm summers after dry winters, nearly all the snow disappears

from the very highest peaks. In northern California, the snow line drops to about 11,000 feet, and Mt. Shasta is capped with ice fields and glaciers.

About San Francisco Bay we find a most remarkable distribution of temperature, altogether unique; the following table will serve as an introduction:

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
SE. Farallone	37.7	123.0	30	50	50	51	52	53	54	55	56	57	56	54	52	53.3
San Francisco (C)...	37.8	122.5	100	50	52	54	56	58	58	58	59	61	59	55	52	56.0
Oakland (C)........	37.8	122.3	70	50	52	54	57	60	62	63	64	62	59	55	52	56.7
Mt. Tamalpais......	38.0	122.7	2370	46	48	51	54	58	63	68	70	66	60	53	48	57.1

On the Farallone Islands there is an annual range of only seven or eight degrees, September being the warmest month, and October being warmer than July; the same type of climate prevails at San Francisco, save that the range has increased to eleven degrees. This curious course of the temperature is due to the suppression of the normally increasing summer warmth by the violent and continuous sea breeze; when this begins to abate, in the autumn, the mean temperature rises, and an occasional hot wind reaches the coast from the interior. Hot weather may occur in May, June, September and October; it is extremely rare in July and August. The following table will illustrate this curious anomaly:

	May, Deg.	June, Deg.	July, Deg.	Aug., Deg.	Sep., Deg.	Oct., Deg.
Average maximum, 30 years....	80	82	79	78	85	82

At Oakland, across the bay, but only five miles from San Francisco, conditions are quite different; the warmest month is no longer September, but August, as

elsewhere in California, and a few hot days are not so uncommon in midsummer. Oakland begins to grow warmer than San Francisco in April and May, is five degrees warmer in summer, but has the same temperature in and after October.

In ascending to the summits of the Coast Range, as at Mount Tamalpais, we find that the sea breeze has disappeared, for it does not reach to this height. The summer is proportionately much warmer than even at Sacramento; San Francisco people ascend the mountains in summer for the sake of greater warmth, instead of cool weather, as elsewhere. Localities under the lee of the Coast Range, as San Rafael, are also relatively warm in summer, but I have not been able to secure reliable data concerning this popular resort.

The average extremes at San Francisco are 90 and 36, the absolute extremes 101 and 29 degrees; killing frost is even rarer than hot weather. In January the daily range is from 45 to 56 degrees, in July from 52 to 64, and in September from 55 to 68.

The coast of northern California has a very similar climate, but the Coast Range is sufficiently high and continuous to cut off all hot winds. August is the warmest month, though September still equals July. The annual range is exceedingly small for the latitude. The following data for Eureka will give ample information:

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Eureka	40.7	124.2	60	46	47	48	50	52	54	56	57	56	53	50	48	51.4

The ordinary extremes are only 75 and 28 degrees,

the absolute extremes 84 and 20; the daily range in January is from 40 to 53 and in August from 52 to 62. It is interesting to compare these figures with those of New York, in exactly the same latitude on the Atlantic Coast, the annual means being almost identical.

Along this entire coast, the summer actually appears colder than the winter, on account of the penetrating winds and damp fogs at the former season.

The interior of California has a climate that partakes of some of the features of the deserts.

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Fresno	36.7	119.7	330	44	49	55	61	68	76	82	82	75	65	54	46	63 1
Sacramento	38.6	121.5	70	46	50	54	59	64	69	73	73	69	62	53	47	59 9
Red Bluff	40.2	122.3	330	45	50	55	61	68	75	81	81	74	65	55	47	63.1

Observe how the summer grows warmer as we depart from San Francisco Bay either to the north or south, also the extreme uniformity of the temperature in winter.

The following table gives the extremes and daily range of temperature in the interior of California:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	Jan.	July
Fresno	110	25	115	20	35—53	65—100
Sacramento	104	28	110	19	39—54	58— 88
Red Bluff	109	26	115	18	37—53	67— 96

Severe frost is unusual, and the minima are higher than in northern Florida. The parching drought and hot winds of the summer are very trying, in spite of

the extremely low humidity; the nights are, however, tolerably cool. Red Bluff is phenomenally warm at all seasons, owing to its exceptionally sheltered situation; Sacramento, as already stated, has its summer heat somewhat mitigated by a remnant of the sea breeze, of course with a slight increase of humidity.

The variability of the temperature on the whole Pacific Coast is small; even if we go some distance inland, we find, in particular, a very steady winter climate. The figures are:

	Winter, Degrees	Spring, Degrees	Summer, Degrees	Autumn, Degrees	Year, Degrees
Coast	2.2	2.0	1.6	2.2	2.0
Inland	3.2	3.2	3.1	3.2	3.2

Note the small seasonal differences.

North of California, the Coast Range becomes very much broken by river valleys, so that the difference in climate between the coast and the interior becomes materially diminished. The maximum temperatures are no higher than in the Atlantic States, and severe frosts may, exceptionally, reach the shores of the Pacific Ocean. In the main, however, oceanic conditions still persist, as westerly winds prevail everywhere in summer, and are very frequent in winter.

The following table will give ample thermometric data:

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Astoria	46.2	123.8	60	41	42	45	49	53	57	61	62	59	53	47	43	51.0
Tatoosh Island	48.4	124.8	90	41	42	44	47	50	53	56	56	53	50	46	43	48.4
Roseburg	43.5	123.4	520	40	43	47	51	56	61	66	66	60	53	46	43	52.7
Portland (C)	45.5	122.7	90	39	42	47	52	57	62	66	66	60	53	46	42	52 7
Seattle (C)	47.6	122.3	120	40	42	46	50	55	59	63	62	57	51	45	42	50.9
Victoria	48.4	123.4	80	38	39	42	47	52	57	60	59	55	49	43	40	48.4

The extremes and daily range are:

	Average		Extreme		Daily Range	
	Max.	Min.	Max.	Min.	Jan.	July
Roseburg	98	18	106	−6	35—46	53—79
Portland	95	15	102	−2	34—45	57—76
Tatoosh Island	75	23	80	+7	37—43	52—61
Victoria	83	16	90	−2	33—44	52—68

The cold waves, as seen above, are quite exceptional, the warm temperate flora of California extends northward as far as the Rogue River; beyond that the summer becomes too cool, even in the interior, and the vegetation begins to resemble rather closely that of northern France and southern Britain, notably in the monotonous character of the tree growth. We may note, in this connection, that Portland and Seattle have almost exactly the temperatures observed in Paris and London, but shall see presently that this similarity does not extend to the other climatic factors in anything like the same degree.

Alaska. The climate of southern Alaska resembles the preceding closely, save that it is a few degrees colder; as we go far westward, however, the summer becomes exceedingly raw and bleak, and the winter also becomes somewhat more severe, though still rather mild for the latitude. The following data are illustrative:

	Latitude	Longitude	January	February	March	April	May	June	July	August	September	October	November	December	Year
Sitka	57.0	135.3	32	32	36	41	46	51	56	56	51	45	39	35	43.3
Unalaska	53.9	166.5	30	29	30	33	38	44	50	51	47	42	36	32	38.5

The reader will note the extreme retardation of the seasons on Unalaska, the best known of the Aleutian Islands; November is much warmer than April, and October almost equal to June.

The rise of temperature on the Pacific Coast, from Sitka to San Diego, is 0.9 degree in January, 0.5 in July, and 0.8 for the year, for each degree of latitude. Between Edmonton and Yuma, in the Rocky Mountain Region, the corresponding figures are 2.3, 1.3, and 1.5; the still greater ones in the east have already been given. We observe, therefore, that the differences due to latitude diminish rapidly westward, being less than half as great on the Pacific Coast as on the Atlantic.

Western Alaska interests us chiefly because of certain recent settlements along Bering Sea; the following approximate data for Port Clarence, near Nome, show that the climate is cold at all seasons:

	Lat.	Lon.	Winter	Spring	Summer	Autumn	Year
Port Clarence........	65.1	165.5	−8	16	48	24	20.0

Our data from the Yukon Valley are still scattered and scanty, but we have the following five-year record from Dawson City, just across the national boundary, which will give at least an approximation:

	Latitude	Longitude	Elevation	January	February	March	April	May	June	July	August	September	October	November	December	Year
Dawson.....	64.1	139.3	1200	−21	−12	3	29	46	58	62	56	43	23	−3	−13	22.8

The average extremes are 88 and −56, the absolute

extremes 95 and −68. The climate resembles that on the Saskatchewan, 1,200 miles to the southeast, but the winter is about ten degrees colder. The Yukon breaks up only about two weeks later than the St. Lawrence, but freezes a month earlier.

CLOUDINESS AND HUMIDITY

There are two recognized methods of calculating the percentage of clouds. One consists in judging the proportion of the sky that is covered, repeating this process at stated intervals during the day, and averaging the results. This method is apt to yield rather high percentages, because the apparent banking of clouds toward the horizon is included in the observer's estimate, and overrated; in addition there is the element of the personal equation, which also has a tendency to overestimation. The second plan consists in employing an automatic sunshine recorder of either the thermographic or photographic type, and deducting the number of hours of sunshine observed from the total time between sunrise and sunset. The defect of this method is the ignoring of the night hours, which form the majority during half the year; this demerit is, however, not very important from the standpoint of medical climatology, which is not in any way interested in the ratio of cloudiness at night, but only in the actual proportion of sunshine. Throughout our territory, the first method gives a ratio of cloudiness from six to ten per cent. higher than the second; in our tables full details shall be given according to the former, supplemented by the somewhat scantier data afforded by the latter, in all cases by small districts,

so as to eliminate the personal equation as far as possible.

The relative humidity will be similarly stated, according to small districts. We have already explained that these figures, by themselves, are almost meaningless, and are really valuable only when referred to the temperature prevailing at the time; it has therefore seemed worth while to go to the trouble of calculating the sensible temperature for the warm months at a large number of stations, in order to render this statistical material really useful. Under this sub-heading, the stations are thrown together into physiological groups, with reference to the indifferent temperature, and we believe that the tables will thus graphically show which places have, respectively, a hot, warm, cool or cold summer, in a way superior to anything of the kind hitherto published. In the more southerly districts similar data are given for the colder seasons; this feature is unnecessary where the thermometer averages below 55 or 60 degrees, as explained in the preceding chapter.

Subarctic North America. Southern Greenland has a pretty uniform ratio of 65 to 70 per cent. of cloudiness throughout the year; Labrador more nearly resembles the arctic regions, having the lowest proportion, about 55 per cent. in spring, and the highest, about 70 per cent. in autumn. In both regions the humidity is high; our data are very scanty, but 75 per cent. in the spring, and 85 per cent. in the fall, will not be far from the truth. The distribution of fogs is quite strictly in accordance with the factors just mentioned.

The Northeastern States and Canada. In this district the distribution of clouds is as follows:

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Newfoundland, Nova Scotia..........	66	63	66	63	63	60	61	56	57	62	71	74	63%
New Brunswick, Quebec............	67	60	56	52	50	48	47	45	50	60	71	72	56%
New England, Middle Atlantic Coast...	56	54	54	51	52	49	48	48	48	49	52	52	51%
Northern Alleghanies................	64	62	61	56	55	54	51	51	51	57	63	64	57%

The coast is almost as clear in winter as in summer, August is the finest month northward, October southward. The inland districts are relatively very cloudy from November to March, a phenomenon as common as it seems paradoxical; in New York the cloudiness in December increases steadily from 55 per cent. on the coast to 85 on Lake Ontario; in summer these two sections differ little, but the intervening mountains are about five per cent. cloudier. Along the coast, from New England to Virginia, we find an average of 2,620 hours of sunshine annually (60%), whereas among the interior highlands the total diminishes to 2,190 hours (50%); these figures correspond quite closely to those for southern and northern Italy respectively.

The distribution of the relative humidity is quite different in summer, though somewhat similar in winter, as follows:

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Atlantic Coast	77	76	77	76	81	82	83	84	82	79	78	77	79%
Atlantic Plain	74	73	70	65	71	72	73	75	77	76	75	74	73%
Northern Alleghanies ..	79	77	76	69	71	73	75	78	79	80	80	80	76%

The effect of the sea fog from May to September, of the cloudy conditions inland in winter, and of the

mountain-valley fogs of autumn, is very apparent. The lowlands away from the coast are relatively dry at all seasons, but especially in winter and spring.

In regard to sensible temperatures, we need consider the warmest three months only, and group the localities as follows:

Summer cold,	52—54 deg.,	Father Point, St. John's.
Summer cool,	54—56 "	Yarmouth, Eastport.
	56—58 "	Chatham, Sydney, Rockliffe.
	58—60 "	Halifax, Charlottetown, Quebec, Northfield.
	60—62 "	Montreal, Ottawa, Portland.
	62—64 "	Boston, Nantucket, Block Island.
Summer warm,	64—66 "	Harrisburg, Albany, New Haven, Atlantic City.
	66—68 "	New York, Philadelphia.
	68—70 "	Baltimore, Washington, Lynchburg.
	70—72 "	Norfolk.

The Lake Region. The distribution of cloudiness in the Lake Region is as follows:

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Western New York	78	71	65	55	52	49	46	47	50	61	76	81	61%
Michigan, South Ontario, North Ohio.	72	67	62	54	52	48	44	44	48	58	72	76	58%
Chicago to Duluth	58	57	55	54	51	50	43	45	48	56	63	64	54%

The cloudiest season everywhere is from November to January; the amount of cloud diminishes irregularly as we go west from Oswego, and falls off rapidly on the west shore of Lake Michigan, the east shore of which has almost as gloomy a winter as western New York; in fact, the relatively mildest stations have the most disagreeable weather. The finest weather is found in summer at Chicago, which has only 40 per cent. of clouds from July to September; southern Michigan has 42.

The general average of sunshine is 2,140 hours (47%), ranging from 2,440 at Chicago to 1,960 at Oswego; even the latter is higher than any record from England,

northern France, or Germany, owing to the brightness of the summer months.

The humidity is pretty uniformly distributed, but is a little higher northward.

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Northern Lake Region..	83	82	79	74	72	73	73	77	78	80	82	82	78%
Southern Lake Region..	81	81	77	71	71	72	70	72	74	74	77	79	75%

The winter is damper in the Lake Region than in the northeast, the summer is nearly the same, and fairly dry for the location. The sensible temperatures for the warmest three months are:

Summer cold, 52—54 deg.,		White River, Port Arthur.
Summer cool, 56—58	"	Marquette, Alpena, Saugeen, Duluth.
58—60	"	Parry Sound, Toronto, Port Stanley, Kingston.
60—62	"	Milwaukee, Grand Haven, Port Huron, Rochester, Buffalo, Oswego, Green Bay.
62—64	"	Erie, Detroit, Chicago, Cleveland.

The Ohio Valley. In this section the cloudiness and humidity are as follows:

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Cloudiness............	66	64	63	55	53	51	45	44	44	50	61	64	55%
Humidity..............	77	75	72	64	66	68	66	69	70	71	74	75	71%

The cloudiness is great for so continental a situation, higher than at many places farther north and east; there are 2,320 hours of sunshine (52%).

The humidity in the summer months is the lowest east of Kansas; Cincinnati and Louisville having an

annual average of only 68 per cent. All places in this region have a warm summer:

66—68 deg., Indianapolis, Pittsburg, Columbus, Parkersburg, Cincinnati.
68—70 " Louisville.

The Upper South. The cloudiness in the upper South follows two types, on the eastern and western slopes of the Alleghanies respectively.

	January	February	March	April	May	June	July	August	September	October	November	December	Year
North Carolina to Georgia (uplands)...	57	54	48	45	46	51	52	53	44	38	44	50	48%
Tennessee and Arkansas............	59	59	52	48	47	47	45	44	42	38	49	55	49%

The eastern slope has a relatively cloudy summer, whereas the west side of the Alleghanies and the Mississippi Valley are quite cloudy in winter, and have a bright summer; both sections have a very sunny October. The proportion of sunshine in this region averages 2,650 hours, 60 per cent. of the possible total.

As regards humidity, the entire region is so uniform that but one statement will be required.

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Upper South..........	74	72	70	65	68	72	75	77	75	72	73	74	72%

Only in northern Tennessee is the summer a trifle less moist than the winter, otherwise it is the dampest season of the year; the result appears in the very high sensible temperatures for the summer:

Summer warm, 68—70 deg., Knoxville.
70—72 " Raleigh, Charlotte, Nashville, Atlanta.
72—74 " Memphis, Little Rock.

At the last two stations the summer is almost tropical.

In the South it is also worth while to give the sensible temperatures of spring and autumn, these being really the best seasons for visitors. I have taken April and October as the representative months for those seasons.

April cool, 52—54 deg., Raleigh, Charlotte, Nashville.
April mild, 54—56 " Atlanta, Memphis, Little Rock.

The October temperatures are just four degrees higher throughout.

The Lower South. In the lower South, we may also distinguish two types of cloudiness, the Atlantic States having a fine winter, and a moderately bright summer, whereas the Gulf States are quite cloudy in winter: both have a fine spring, and a wonderfully bright autumn.

	January	February	March	April	May	June	July	August	September	October	November	December	Year
North Carolina to Georgia (lowlands)	51	51	46	43	43	50	49	51	48	39	44	47	47%
Alabama to Louisiana	56	55	47	46	43	49	51	48	43	36	44	52	48%

There are about 2,750 hours of sunshine, 62 per cent. of the possible total.

The distribution of relative humidity varies chiefly according to the distance from the coast, but the summer is very moist at all stations, the chief difference being in spring and autumn.

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Coast	80	80	78	76	77	80	81	83	81	79	80	80	80%
Interior	75	73	69	67	68	73	77	80	76	73	74	75	73%

At Cape Hatteras the humidity ranges between 81 and 84 per cent. throughout the year.

The sensible temperature, in summer, is everywhere between 74 and 76 degrees, and therefore quite tropical. The spring (April) temperature is as follows:

Mild,	54—56 deg.,	Augusta.
	56—58 "	Wilmington.
	58—60 "	Vicksburg, Montgomery, Charleston, Savannah.
	60—62 "	Jacksonville, Mobile.
	62—64 "	New Orleans.

The autumn (October), on account of the greater humidity, has higher sensible temperatures than the spring, even where the dry thermometer ranges no higher.

Mild,	58—60 deg.,	Augusta.
	60—62 "	Mobile, Montgomery, Vicksburg, Wilmington.
	62—64 "	Charleston, Savannah.
Warm,	64—66 "	Jacksonville, Mobile.
	66—68 "	New Orleans.

In the eastern states, the usual duration of the uncomfortably warm season is as follows, varying, of course, in different years:

New York, Pittsburg, Omaha: June 15th to September 1st.
Washington, Cincinnati, St. Louis: June 1st to September 15th.
Raleigh, N. C., and Nashville: May 20th to September 25th.
Charleston, Montgomery, and Vicksburg: May 10th to October 10th.
Jacksonville and New Orleans: April 20th to October 20th.
Middle Florida: April 1st to November 10th.
South Florida: March 10th to December 1st.

The best months for health-seekers and tourists are:

New York, Pittsburg, Omaha: May, September and October.
Raleigh and Nashville: April, October and November.
Jacksonville and New Orleans: March, November and December.
South Florida: the winter months.

In the first three of these the last-named month is subject to cold often sufficiently severe to make wraps and artificial heat necessary for comfort.

Florida. The cloudiness and humidity are as follows in the Florida peninsula:

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Cloudiness	47	47	41	40	44	54	49	51	53	46	46	46	47%
Humidity	81	80	78	74	76	80	79	80	82	80	80	81	79%

The cloudiness closely follows the distribution of the rains; the finest season is in spring, just before the summer deluge begins. Key West has 3,060 hours of sunshine, 68 per cent. of the possible total, and only about 55 cloudy days in the year; the figures for the peninsula proper are nearly as favorable; there is a marked tendency in the rainy season to a clear sky in the daytime and clouds at night.

The sensible temperatures are:

	Winter, Degrees	Spring, Degrees	Summer, Degrees	Autumn, Degrees
Tampa	56	66	77	69
Jupiter	61	67	76	71
Key West	66	70	77	73

The Mississippi Valley, etc. There are several types of cloud distribution in the Mississippi Valley, also westward and northward; we may form the following groups:

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Missouri, Illinois, Iowa	53	54	54	52	51	49	42	40	41	41	51	56	49%
Wisconsin, Minnesota	52	52	55	54	53	52	44	45	47	51	58	57	52%
East Kansas and Nebraska	44	48	49	49	49	43	40	39	37	36	42	46	44%
East Dakotas and Manitoba	44	48	50	51	51	48	42	40	44	51	52	50	48%

In the Mississippi Valley the brightest season shifts from October to July, as we go northward, while December is the cloudiest month throughout. Farther westward there are two clear and two relatively cloudy seasons, but they are unequal in degree. There is everywhere a tendency for the autumn to become less pleasant as we go north. The more southerly portions of this region represent that part of the continent where the Indian summer is most typically developed.

The amount of sunshine varies between 2,600 and 2,800 hours, 58 to 62 per cent. of the possible total.

The relative humidity is distributed so uniformly through this region, that any division into subdistricts is difficult; we shall do best by throwing all our records together, as follows:

January	February	March	April	May	June	July	August	September	October	November	December	Year
78	77	73	67	67	70	68	70	70	70	74	78	72%

These figures are decidedly high for the center of a continent; 62 per cent. in April and May, on the western edge of this region, is the lowest recorded.

The sensible temperatures for the summer are as follows:

Cool,	56—58	deg.,	Winnipeg.
	58—60	"	Moorhead.
	60—62	"	St. Paul, Huron.
	62—64	"	La Crosse.
Warm,	64—66	"	Des Moines, Omaha.
	66—68	"	Kansas City, Wichita.
	68—70	"	St. Louis.
	70—72	"	Cairo.

The South Central States. In the South Central States the distribution of cloudiness is as follows:

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Oklahoma.............	46	51	43	42	45	38	36	35	33	30	39	45	40%
East and South Texas....	54	55	52	51	48	43	38	42	43	37	46	51	47%

Note the suggestion of a July drought in Texas, as shown by the low percentage of clouds; and the clearness of October throughout.

The amount of sunshine ranges from 2,800 hours on the coast of Texas to 3,100 in Oklahoma (62 to 69%).

The humidity is excessively high on the coast, but moderate even a short distance inland.

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Coast of Texas......................	84	84	83	83	81	81	79	80	79	77	81	82	81%
Interior of Texas, Oklahoma	73	71	68	68	72	73	71	71	71	69	71	71	71%

The sensible temperatures are as follows:

Summer warm,	68—70	deg.,	Oklahoma.
Summer hot,	74—76	"	Shreveport, San Antonio.
	76—78	"	Galveston, Corpus Christi.
Spring (April) mild,	54—56	"	Oklahoma.
	58—60	"	Shreveport.
	62—64	"	San Antonio.
Spring warm,	64—66	"	Galveston, Corpus Christi.

The fall ranges about two degrees higher than the spring.

Over the whole area so far discussed the climate is either moist or of medium humidity, never dry; the lowest monthly humidity, even in spring, has in no case fallen under 62 per cent., and we have met with this as far east as Cincinnati and even Baltimore. The lowest

proportion of clouds has been about 40 per cent. for the year, in Kansas and Oklahoma, but this figure, also, is not much below some records on the Atlantic Coast, where 46 per cent. is noted at several stations.

West of the 98th meridian, we encounter a great and rapid change, and we find a very different state of things on.

The Great Plains. The ratio of clouds is not so very greatly diminished on the Great Plains, which we may subdivide in the same manner as we did in discussing the temperature.

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Colorado and Western Kansas	35	39	39	37	39	38	38	41	36	29	34	36	36%
Wyoming and Western Nebraska	38	40	45	48	51	40	43	40	33	35	36	40	41%
Montana and Western Dakotas	50	52	53	54	53	52	40	37	41	48	49	51	48%
Saskatchewan and Alberta	56	56	57	55	53	56	44	40	48	54	54	55	52%

These figures are only a few per cent. lower than in the well-watered region eastward. On the middle slope, the cloudiness follows the rainfall closely; this is not the case farther south or north; in the former direction the rainy season is unduly clear, and in the latter the almost rainless winter is quite cloudy and, as we shall see, also damp.

The amount of sunshine is, indeed, large, but not phenomenal for so dry a region, ranging from 2,700 hours (60%) on the upper Missouri to 3,200 (71%) at Denver; thus Colorado is not far ahead of Kansas and Oklahoma in this respect; still, Denver has 190 clear and only 55 cloudy days in the year, whereas New York City has about 130 of each.

The humidity, in general, decreases with the altitude, that is, with the proximity to the mountains. There is, however, a considerable difference according to latitude, the dividing line being at about the 42d parallel, north of which the winters are as damp as in the eastern states, while the summers are dry. Our records are:

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Western Kansas and Nebraska	70	70	64	61	65	64	62	63	64	64	66	68	65%
Western Dakotas	77	77	74	64	60	63	59	58	61	68	74	76	68%
Texas Panhandle to Black Hills	65	64	59	54	56	58	55	56	56	59	62	65	59%
Colorado and Wyoming	53	56	51	49	52	49	49	48	44	47	50	52	50%
Montana	69	67	62	54	53	50	45	45	50	58	64	68	57%

The most remarkable feature of this table is the May humidity of 52 per cent. at Denver, in association with abundant rains. The sensible temperatures for the summer are, as will be seen, exceedingly low in comparison with the readings of the ordinary thermometer previously given.

Cold.	50—52	deg..	Edmonton, Prince Albert.
	52—54	"	Lander, Helena.
Cool.	54—56	"	Regina, Medicine Hat, Cheyenne, Havre.
	56—58	"	Williston, Rapid City, Denver.
	58—60	"	Bismarck.
	60—62	"	Pierre, North Platte.
Warm.	64—66	"	Amarillo.
	66—68	"	Dodge City.
	70—72	"	Abilene.

The Western Plateau. Here we encounter an approach to absolute clearness for the first time, the proportion of clouds for the summer and early autumn becoming very low indeed. The figures for the winter are fairly high even in the Great Basin, and become very high northward, so that the wet season in those parts becomes quite gloomy, recalling the least favored

portions of the eastern states, without attaining the high percentages of certain parts of the Lake Region.

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Utah and Nevada....................	48	48	49	45	41	30	20	22	25	32	36	51	37%
Idaho, East Oregon and Washington..	66	61	56	55	49	47	26	21	34	47	54	67	49%

The amount of sunshine declines from 3,000 hours (67%) in Utah and Nevada to 2,600 (58%) in eastern Washington.

The distribution of the relative humidity is similar, the winter being moderately moist, the summer exceedingly dry and even desert-like.

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Utah and Nevada....................	70	64	55	45	46	38	32	33	38	48	58	70	50%
Idaho, East Oregon and Washington..	79	74	66	56	56	51	41	42	51	62	74	79	61%

The resemblance of this region to Central Asia is remarkable; the vegetation of the two regions is also very similar, presenting many types that are uncommon in other portions of the globe.

The sensible temperatures of the summer are extremely low; the difference between shaded and sunny situations is enormous; the former are unfortunately hardly obtainable except in the towns, for, southward at least, the country is almost bare of trees, though there are fine forests in the northern parts. The figures are:

52—54 deg., Carson, Winnemucca, Baker City.
54—56 " Spokane.
56—58 " Boisé City, Salt Lake City.
58—60 " Walla Walla.

The Southwest. The proportion of clouds in the Southwest is very small, with minima in spring and autumn, and maxima in winter and midsummer. Toward the east the midsummer maximum leads, in the desert the winter maximum, but in the latter this "cloudy" season is clearer than any month east of the Missouri River.

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Western Texas and New Mexico	32	35	34	31	32	32	41	42	34	26	30	32	33%
Arizona	31	32	30	23	18	17	42	41	21	18	19	30	27%
Southeastern California	27	29	29	22	19	11	16	20	14	17	21	30	21%

Santa Fé has 3,400 hours of sunshine (76%), Phœnix 3,730 hours (83%), Yuma about 4,000 hours (89%). Yuma has 308 clear and only 12 cloudy days in the year, and is probably not surpassed in this respect by any spot on the globe.

The humidity is generally lowest in spring, but very low at all seasons.

	January	February	March	April	May	June	July	August	September	October	November	December	Year
West Texas to Arizona	51	47	37	30	29	27	43	45	44	44	45	47	41%
Southeastern California	48	39	35	30	30	27	30	35	32	37	39	44	35%

In Death Valley the average for the summer is 20 per cent., and for the year barely 30 per cent., rivaling the interior of the Sahara.

The sensible temperatures are relatively very low, but here we note the inadequacy of this method of

recording our perception of heat in the desert. As a matter of fact, the fearful noon heat in the lowlands, with the sun almost vertical, is quite unendurable.

Summer cool,	52—54 deg.,	Santa Fé.
	54—56 "	Independence.
Summer warm,	64—66 "	El Paso.
	68—70 "	Phœnix.
	72—74 "	Yuma.

At Yuma, the summer is almost tropical in its sensible temperature, in spite of the very great dryness; it is therefore ridiculous to say that the heat is not felt; at best, in the shade, it feels almost as hot as on the South Atlantic Coast; in the sun it is an inferno.

The Pacific Coast. In reviewing the ratio of cloudiness on the Pacific Coast, we must bear in mind the four main factors that determine it. They are: first, the tendency to increase northward; secondly, the summer drought in the interior; thirdly, the summer sea fogs on the coast; fourthly, the tendency in winter to clearer weather on the coast than inland. In the following table the relation of these elements is evident:

	January	February	March	April	May	June	July	August	September	October	November	December	Year
South California Coast...	38	40	43	46	50	44	42	39	34	35	31	39	40%
Middle California Coast..	51	49	51	52	51	44	47	45	40	41	39	49	47%
North California Coast...	64	64	66	66	64	60	56	52	52	53	56	65	60%
Oregon Coast...........	70	68	69	67	65	62	59	54	58	59	65	71	64%
Washington Coast.......	76	73	72	69	66	64	62	56	64	66	74	78	68%

The northwest coast has the gloomiest climate in North America; the ratio of clouds continues to increase northwestward, reaching 82 per cent. on Unalaska Island. Inland the figures are:

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Great Valley of California	48	48	42	35	30	16	7	7	13	22	30	53	29%
Western Oregon, interior	70	69	64	63	56	55	34	28	39	54	62	71	55%
Western Washington, interior	76	72	65	63	57	58	41	38	51	66	72	79	61%

The clearness of the summer of interior California is so great as to be monotonous, and it is considerable even on Puget Sound. In winter there is a rapid transition from the very bright weather of southern and central California to the gloomy conditions northward; the change takes place rather suddenly, at about the 40th parallel, both on the coast and inland. In summer the increase northward is gradual everywhere, but the sky clears abruptly on crossing the Coast Range eastward.

Tatoosh Island has only 1,560 hours (35%) of sunshine, Seattle and Portland have 1,980 hours (44%), Eureka has 2,070 hours (46%), the southwest coast 3,200 (71%), and the Great Valley 3,400 (76%).

On the coast itself the humidity steadily rises from moderate proportions in the south to extraordinarily high figures northward, the summer or autumn being the dampest season. In the interior the winter is moist, and the summer is very dry in the south and moderately so northward. The following table will show this more fully:

	January	February	March	April	May	June	July	August	September	October	November	December	Year
South California Coast	69	69	72	72	75	75	75	76	73	74	68	65	72%
Middle California Coast	80	78	78	78	79	80	84	86	81	79	77	80	80%
North California Coast	86	85	84	86	86	86	88	90	89	89	87	85	87%
Oregon Coast	88	87	87	88	89	88	89	90	91	92	90	88	89%
Washington Coast	90	89	90	91	92	91	91	92	93	94	94	92	92%

The dampest month gradually shifts from August to October. The figures inland are:

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Great Valley (except Sacramento)	80	70	66	58	53	41	33	35	42	54	65	81	57%
Sacramento	80	73	70	65	66	59	58	58	57	62	69	81	66%
West Oregon, interior	85	81	75	70	69	68	63	65	70	79	84	87	74%
West Washington, interior	84	79	75	71	71	70	67	71	76	81	84	84	76%

The relative dampness of Sacramento in summer is due to the same cause as the only moderately high temperature, namely, a slight remnant of the sea breeze blowing in through the Golden Gate; this place is, however, no cloudier than the other interior points, the sea fog does not penetrate nearly so far.

The sensible temperatures range as follows; they are quite low at the inland stations, but the remarks made in reference to the near-by deserts apply here equally well. As the spring and later autumn are pleasantly cool everywhere, we shall consider the summer data only.

52—54 deg.,	Victoria.
54—56 "	Tatoosh Island, Eureka, Seattle.
56—58 "	Portland, Roseburg, San Francisco.
62—64 "	Fresno, Red Bluff, Sacramento, Los Angeles, San Diego.

We may close this division of our subject with the following brief summary: In winter there are maxima of cloudiness in the far Northwest and the Lake Region, both exceeding 80 per cent.; there is a minimum of 42 per cent. at Key West, and one of 24 at Yuma. In summer the farthest Northwest and Northeast have each about 60 per cent., whereas we find 32 per cent. in Oklahoma, and less than 10 per cent. in Central

California. For the year, we have over 70 per cent. on the Alaskan Coast, and only 18 per cent. at Yuma.

The winter maxima of humidity are 82 per cent. over the upper Lake Region and the Texas Coast, and 90 in the far Northwest; the two latter persist in summer, but the first shifts to the islands off the Atlantic Coast. The eastern minima are 74 per cent. in the Atlantic Plain in winter and 66 per cent. in the Ohio and Missouri Valleys in summer; westward the lowest figures are reached on the southeastern slope of the Rocky Mountains and in the southwestern deserts.

The average amount of sunshine is 2,600 hours in the eastern half of the United States, and 2,950 in the west, the absolute extremes being attained at Tatoosh Island and Yuma, respectively.

PRECIPITATION

The Gulf of Mexico is the chief source of moisture for eastern North America. During the colder months, the southwest winds in the southern quadrant of the transcontinental storms bring abundant moisture to the territory lying east of a line running from the mouth of the Rio Grande to Lake Michigan. In summer, the well-defined storms are less important, but the barometric depression in the Southwest causes a steady indraught of warm and moist southeast winds; the rains are therefore carried northwestward as far as the Continental Divide.

East of the Alleghanies, there is an additional supply of moisture from the Atlantic Ocean, brought to the land by northeast winds; this source of rain is, however, subordinate to the preceding, except in the upper Lake

Region and from there to the northeast coast. These rains are of most account in the autumn and winter.

In the subarctic regions we have the minimum in spring and the maximum in fall; that is common to almost all far northern localities.

The entire East may therefore be subdivided as follows:

I. The subarctic regions; precipitation as above.

II. The Northeast, including the Lake Region; a fairly even distribution throughout the year, with a tendency to an autumn maximum far northward, a winter maximum far eastward, and summer maximum inland and toward the south.

III. The Southeast; summer rains everywhere, winter rains in the mountains, but a dry winter on the Atlantic Coast and in Florida.

IV. The Mississippi Valley and the Great Plains; summer wet, winter moderately dry in the south, very dry in the north.

The Pacific side of the continent depends chiefly on the Ocean for its moisture, a little comes to the far Southwest from the Gulf of California. The rains follow the common rule of falling only when the land is cooler than the sea, and the cool months are therefore the wettest. The total falls off rapidly as we go south from Puget Sound, and southward the summer becomes absolutely rainless. The arid Southwest gets practically no rain, except in summer in the uplands, where warm Southwest winds from the Gulf of California deposit some moisture in ascending; this rainy season is a mere remnant of the tropical rains of Mexico, and limited to the hottest months.

We may therefore divide the western region as follows:

V. The Western Plateau (north of latitude 37°); some rain in winter and spring, very little in summer and autumn.

VI. The Southwest; rain in midsummer in the mountains, otherwise perennial drought.

VII. The Pacific Coast; similar to district V, but wetter in winter and drier in summer, with an extreme difference between the north and south.

Our tables will embrace only long records, which have been grouped according to states and districts, both to compensate for local errors, and because precipitation is more a regional than a local phenomenon. Owing to large annual variations, data of rainfall cannot pretend to the accuracy of those given for temperature or humidity; the probable error in the annual means for even twenty-five years varies from two per cent. on the Atlantic Coast to more than five on the Pacific, and is over three times as great as this for the monthly means.

It is also important for us to know the number of wet days, the amount and frequency of snow, and the rain intensity. The number of days with thunderstorms is also useful. All these matters, with other serviceable data, will be referred to frequently as we go on.

I. *Subarctic North America.* Southern Greenland and the coast of Labrador are so much alike that they may be thrown together; they agree with the other subarctic climates throughout the world in having the heaviest precipitation from July to October.

January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches
1.6	1.6	1.8	1.6	2.1	2.4	3.0	3.5	4.0	3.0	2.2	1.6	28.4

There are 160 to 200 wet days, about half of them with snow, which may fall even in midsummer, and attains a total depth of ten to fifteen feet. Owing to the coldness of the summer, thunderstorms are quite uncommon.

II. *The Northeastern States and Eastern Canada.* As before stated, this extensive region is notable for a certain uniformity in precipitation; we may, however, recognize a number of subdivisions, which present moderate differences.

In the farthest Northeast nearly all the months are quite wet, but there is a decided excess in the six months from October to April; June and September are regularly a trifle drier than the others.

	January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches
Newfoundland, Nova Scotia, E. New Engl'd	4.6	4.2	4.4	3.4	3.8	3.4	3.8	3.8	2.8	4.8	4.6	4.4	48.0

Immediately to the west of this district the summer is somewhat in excess, but the winter remains very moist.

	January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches
New Brunswick, Quebec, W. New England, E. New York, New Jersey	3.4	3.0	3.4	2.6	3.2	3.2	4.2	4.0	3.2	3.2	3.4	3.2	40.0

In the Lake Region the autumn months lead in the north and east, and the summer months in the south and west; early spring is dry everywhere, and the winter also, except eastward.

	January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches
E. Lake Region...........	2.9	2.7	2.7	2.1	2.9	3.0	3.0	2.6	3.1	3.3	3.5	3.2	35.0
N. Lake Region..........	2.0	1.6	1.8	1.6	2.6	2.8	3.0	2.8	3.8	3.2	2.6	2.2	30.0
S. W. Lake Region......	2.0	2.1	2.2	2.4	3.5	3.8	3.2	3.0	3.2	2.8	2.6	2.2	33.0

The greater part of the Middle Atlantic States and the Ohio Valley have maxima in summer and winter, and a minimum either in spring or autumn, but moderate in either case.

	January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches
S. New York, Pennsylvania, Maryland, Virginia, W. Virginia, Ohio, Indiana	3.4	3.4	3.4	3.2	3.8	4.0	4.0	3.8	3.2	2.8	3.0	3.0	41.0

The tables given will render the detailing of minor variations superfluous. The number of wet days ranges from 120 on the Middle Atlantic Coast, the Ohio River and the southern tip of Lake Michigan to 160 in the extreme Northeast and 170 in the northern and eastern Lake Region. Snow falls on 10 to 20 days in Virginia, 20 to 30 from Long Island to Indiana, but as many as 40 to 60 in the northern Alleghanies and 80 to 90 in the northern sections that have a wet winter. The number of thunderstorms gradually increases from ten per annum in the far Northeast to forty in Virginia and Ohio. The

depth of snow, only about a foot for the entire season in southern Virginia, increases rapidly northward to a maximum of ten or twelve feet in the St. Lawrence Valley and certain localities in the Lake Region; few points north of the 42d parallel have less than four or five feet in all.

In the Lake Region, we invariably find the heavier snowfall on the milder shore, the northwest winds are warmed on crossing the lakes and become loaded with moisture, which is promptly condensed on reaching the cold bank opposite; the remarkable phenomenon is then presented of a heavy precipitation with a rising barometer on the lee side of the lake, while the windward shore enjoys fine and cold weather. In summer, these differences almost disappear, owing to the more uniform barometric and thermometric conditions; they are also far less marked in mild than in severe winters; in the latter the climate of such places as Oswego, Buffalo and Grand Haven is exceedingly disagreeable, though not nearly so cold as at the stations across the respective sheets of water. It must be remembered that the Great Lakes do not freeze over even in the severest seasons.

The duration of the snowy season naturally varies widely according to the latitude. In the coldest sections, only July and August are free from snow, which falls frequently in late September and not so very exceptionally in early June; the ground is permanently covered from November until April in ordinary years, and the usual depth on the first of March is from three to five feet on the level. Along the southern border of this region, from Cape Cod to Cincinnati, snow is

uncommon in October, and very rare indeed in May except in New England; the ground is rarely covered continuously for more than a month, and may be bare for weeks at a time in the dead of winter, as in 1906.

III. *The Southeast.* This region is decidedly more heterogeneous than the preceding, and requires considerable subdivision.

In the Cape Hatteras region and on the Bermudas all the months are wet, but the late summer and early autumn lead.

	January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches
Hatteras	5.9	4.5	6.1	4.7	4.6	4.6	6.4	6.4	6.4	6.2	5.2	5.5	66.5
Bermudas	4.8	4.4	5.6	4.5	4.8	5.9	4.6	6.1	5.5	8.3	4.2	4.3	63.2

On the South Atlantic Coast and in Florida, also in southern Texas, we have the dry and cool and wet and warm seasons of the West Indies and Central America.

	January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches
Lowlands of N. C., S. C., Ga., and Florida	3.8	3.2	3.8	3.4	4.2	5.6	6.2	6.8	6.8	5.0	3.0	3.2	55.0
South Texas	1.9	1.7	1.5	1.8	3.0	2.7	1.8	3.3	4.8	2.0	2.0	1.5	28.0

A peculiar feature is the midsummer drought that appears at Galveston and becomes extreme in southernmost Texas.

In the southern Alleghanies, along the lower Mississippi and on the middle Gulf coast there is more rain in winter; October is quite dry everywhere.

	January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches
South Alleghanies	4.8	4.6	5.2	4.0	3.8	4.2	4.6	4.6	3.4	2.8	3.2	3.8	49.0
Middle Gulf Coast	4.6	4.0	4.4	4.0	4.2	5.6	5.4	6.4	5.6	3.6	4.0	4.2	56.0
Lower Mississippi Valley	4.8	4.6	5.0	5.0	4.8	4.2	3.6	3.2	3.2	2.8	4.6	4.2	50.0

A few explanatory remarks are indispensable. The October maximum of Bermuda also occurs at Jupiter, Fla., and affects the figures for Hatteras, as we have seen; the cause of this peculiarity, which these points share with the more easterly Antilles, lies in the course of the autumn hurricanes along the Gulf Stream, near all these stations. In the southern Alleghanies we find the rare phenomenon of a maximum precipitation in winter far inland; this peculiarity also affects their western foothills as far as Nashville and Montgomery, and is due to the condensation of warm and moist southwest winds from the Gulf of Mexico. Southern Texas, as noted, has a very dry winter and suffers from severe drought in midsummer, so that this section becomes almost desert-like in July. The Atlantic Coast from Cape Fear southward, including the whole Florida peninsula has a distribution of rainfall precisely like that of the West Indies; the year consists of well-marked dry and rainy seasons, the former from October or November to May, the latter embracing variously four to six months; thus visitors to this section are sure of much fine weather at the very season when the upper South, especially among the hills, is almost drowned in torrential rains, with occasional snow. It will be noted that the summer is wet almost everywhere; this circumstance, in combination with the high temperature and humidity noted

in previous paragraphs, fully accounts for the insalubrious character of the four warmest months south of the 37th or 38th parallel.

The remaining peculiarities of the southeast require but cursory mention. Glancing at this region as a whole, we note three centers of especially heavy precipitation, each exceeding sixty inches per annum, situated respectively in the highest Alleghanies, on the middle Gulf coast, and near the Gulf Stream. We have no good records for the first of these, but the others are well displayed in the preceding tables; Jupiter, Fla., also, has a total of 58 inches, 19 of which are equally divided between September and October.

The number of rainy days is almost everywhere in the ratio of one to each 0.45 inch of rain, being 100 at Key West, 150 at Bermuda, 120 to 130 at almost all other stations east of the Mississippi, 100 to 110 west thereof as far as Galveston and Palestine, Tex., 80 at San Antonio and Corpus Christi, and only 50 to 60 on the lower Rio Grande. The amount for each rainy day is thus seen to be very great, and so-called cloudbursts are rather frequent throughout the South. A precipitation of two inches within an hour is common in many parts of the United States, and three inches in an hour have been recorded at places so far apart as Rio Grande City, Jacksonville, Philadelphia and Dodge City, Kan. A fall of ten inches in twenty-four hours is not very uncommon in the South, but rare in the North, where even six inches in a day are quite infrequent.

Snow is common in the southern states only in the Alleghanies and Kentucky, where about two feet fall on fifteen days; in Arkansas, western Tennessee, and

the Cape Henry district some six to twelve inches fall on about seven days; at Wilmington, Montgomery and Vicksburg an inch or two on a day or two. In the extreme South snow falls about once in two years, and lies on the ground about once in a decade, and in the Florida Peninsula snow is a very great rarity, though a few flakes have been observed as far south as Punta Rasa; the same is true of the Bermudas.

Thunderstorms average 40 to 70 per year, the latter in Florida, where they are common at all seasons, except the latter part of autumn. Tornadoes are quite frequent and destructive in the lower Mississippi Valley, less so east of the Alleghanies; southward they are commonest from February to May, northward from April to June; the weather is too steady for their development in midsummer and thereafter.

IV. *The Central States.* Northwest of a line drawn from Indianapolis to San Antonio, Texas, from Lake Michigan to the crest of the Rocky Mountains, we have a wonderfully uniform and typically continental distribution of precipitation. The maximum regularly falls in June—occasionally May or July—and the period from October to March is relatively very dry. Careful study shows that this region is saved from absolute drought only by the great southwestern depression and the resulting southeast winds, both of which conditions are prevalent only from April to August or September; extension of the depression toward the Mississippi, as in July, 1901, causes a shifting of the winds to southwest with serious drought far eastward.

Owing to the mentioned remarkable uniformity of precipitation, one table will suffice for nearly the entire

central region. It is of interest to note a gradual decline from south to north, especially in the winter months, and a falling off from east to west, also most marked in the colder season. In eastern Nebraska only 8 per cent. of the total falls in winter, but 43 per cent. from May to July.

	January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches
Upper Mississippi Valley	1.4	1.6	2.0	2.8	4.0	4.6	3.6	3.2	3.0	2.4	1.8	1.6	32.0
Plains, East	1.0	1.2	1.8	3.0	4.2	4.2	3.6	3.0	2.6	1.8	1.4	1.2	29.0
Plains, West	0.8	0.8	1.0	1.8	2.6	3.4	2.4	2.0	1.4	1.2	0.8	0.8	19.0
Rocky Mts., East. Slope	0.4	0.6	0.8	1.6	2.2	2.0	1.6	1.4	0.8	0.8	0.4	0.4	13.0
N. W. Canada	0.6	0.8	0.8	0.8	1.8	3.0	2.6	2.2	1.4	0.8	0.6	0.6	16.0

In western Montana the type is somewhat mixed, Helena has a little more precipitation in winter, coming from the Pacific Ocean across the watershed, which is somewhat lower in Montana than farther south; this is shown by the following data:

	January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches
Helena	1.4	0.8	0.6	1.1	1.6	2.4	1.1	0.6	1.2	0.9	0.7	0.9	13.4

In the above extensive region it will be noted that, toward the south and west, there is a tendency for the maximum precipitation to occur in May, while northwestward there is a tendency to a July maximum. The decrease westward is very marked, occurring rather abruptly in the 200-mile strip between the 96th and 100th meridians. This belt does not, however, represent a constant dividing line, but an area of uncertain

rains, being dry in one year and moist in another; farther east drought is exceptional, occurring possibly once in a decade, farther west it is common, indeed almost certain, so that the farmer learns to depend chiefly on irrigation.

Among minor matters we may note a tendency to autumn rains in the Upper Mississippi Valley, coming from the upper Great Lakes, and associated with the rainiest season in that section; also, on the southern slope, a small proportion of the late summer rains of the southwestern Rocky Mountain Region. Neither of these features, however, obscures the general type to any marked degree.

The number of wet days ranges from 120 along the middle Mississippi River to 65 in Wyoming and Colorado; it snows on 10 days in Oklahoma, 30 to 40 in Colorado and Wyoming, and 40 to 50 in the north, the total depth of snow ranging similarly from one to six feet. The Great Plains have much less snow than the northeastern mountains and the Lake Region, contrary to the popular belief; the ground is sometimes bare in January and February almost to the international boundary, for the heavy blizzards and general snowstorms occur only at long intervals, and are commoner in autumn and early spring than in midwinter.

Thunderstorms are common everywhere, occurring on 20 days annually in the northwest and 50 days in the southeast of this territory. The eastern and southern portions of this region are peculiarly subject to the most destructive kind of tornadoes; these whirlwinds seem to be especially frequent in Missouri and eastern Kansas, but rare north of South Dakota and west of the 100th

meridian. The occurrence of hot winds has been dealt with sufficiently on page 87.

V. *The Western Plateau.* Here the type of precipitation is almost exactly the opposite of that described above in discussing the eastern slope. Strictly speaking, however, this is true only between the 37th and 49th parallels; the section farther south will be dealt with separately, that farther north has a distribution of moisture resembling that of the Atlantic states.

In the Great Basin and Idaho intense drought prevails from July to September, reducing the country to the condition of an absolute desert, except along the few water courses; the spring is a little moister than the winter in the east of the plateau, and drier in the west, where the conditions on the Pacific Coast are much in evidence; the differences are, however, so slight that one table will suffice:

January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches
2.0	1.5	1.6	1.4	1.4	1.2	0.4	0.4	0.6	1.0	1.4	2.0	15.0

These figures comprise a minimum annual precipitation of 9 inches in central Nevada and a maximum of 18 on the upper Columbia River; the number of wet days is 60 in the former district and 120 in the latter, so that only about 0.15 inch falls on each day; apart from the rare cloudbursts, the precipitation consists chiefly of light drizzles and mere flurries of snow.

The number of days with snow varies similarly from 25 to 50 per year, the relatively large number being due

to the wet period occurring in winter; the depth of snow is from 2 to 4 feet. Thunderstorms are uncommon, because the summer is too dry; they number from 4 to 12 per annum.

In interior British Columbia the type is evidently mixed, but our records are still short, and embrace but few stations. The total rises from 12 inches in the river valleys to 30 and more in the mountains; one-third falls in summer and about a fourth each in autumn and winter, the spring being relatively dry; the conditions thus resemble those in the North Atlantic States. The winter snows in the British Rocky Mountains attain a depth of 15 feet, exceeded only in the California Sierra.

VI. *The Southwest.* The rain-shed between the Gulfs of Mexico and California does not correspond to the surface drainage, but lies on the crest of the Guadalupe Mountain range, west of the Pecos River. The dividing line is not very sharp, because moisture seems to cross over, at times, in either direction, and because the wet and dry seasons are nearly the same on both sides; the July drought is, however, characteristic of the eastern slope, and absent in the west.

In western Texas and in New Mexico more than half of the total precipitation is crowded into July, August and September, with an evenly distributed and very light rainfall during the remainder of the year. In Arizona there is a little rain in winter, coming from the Pacific Ocean, but April, May and June are almost rainless. The totals, exceeding 20 inches in parts of the mountains, fall below 10 at El Paso and 7 at Phœnix, where the truly desert conditions of the southwestern lowlands become manifest. I give the following table:

	January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches.
W. Texas and New Mex...	0.6	0.6	0.6	0.6	1.0	1.2	2.8	3.0	2 0	1 2	0.6	0.8	15 0
Arizona................	1.2	1.2	1.2	0.6	0 4	0 4	2 8	2 8	1 4	0 8	0 8	1.4	15.0

In northern Mexico the rains arrive a month earlier and are more abundant; Chihuahua has about 25 inches, three-fourths of which fall from June to August; in the city of Mexico 70 per cent. of the total (23 inches) fall from June to September; at Mazatlan 25 out of 35 inches fall from July to September, whereas February to May are almost rainless.

In the upper Colorado Valley, in Colorado, southern Utah and Nevada, the type is mixed, with no well-marked annual period; the rains of the Southwest as well as those of the Great Basin almost disappear, so that the total is phenomenally small for the elevation and rugged topography.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
0.8	0.4	0.6	1.0	0.8	0.4	0.8	1.2	0.8	0.8	0.8	0.6	9.0 ins.

There are 90 wet days at Santa Fé, and only 45 at Phœnix; the combination of usually very light rains with rare cloud-bursts characterizes this section as well as the northern Plateau. There are about 30 days with three feet of snow in the higher uplands, three days with as many inches at El Paso, and a few flakes about once in two years at Phœnix. As the rainy season occurs in midsummer, thunderstorms are relatively common, 20 to 40 per year. Tornadoes are quite unknown, and general storms of the usual description are rare, for the

great barometric depressions rarely pass through this district; some recent winters have, however, proved exceptional in this regard. The terrific dust storms, which are especially common in spring, more than make up in discomfort for the absence of the wet spells of the eastern states.

VII. *The Pacific Coast.* We may begin the review of this region with a glance at the deserts near the Colorado River. Here the winter rains, such as they are, already predominate, and but little moisture strays in during the summer from the Gulf of California; the total precipitation is very small throughout, as follows:

	January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches.
Southeastern California .	0.6	0.6	0.4	0.2	0.0	0.0	0.2	0.2	0.1	0.2	0.2	0.8	3.5

At an elevation of even 3,000 feet, the total is but little higher; in the great depressions below the sea level, it is barely two inches. Almost infinitesimal as are these amounts, they even so are chiefly due to cloud-bursts, occurring at long intervals; thus, Yuma had three inches of rain in February, 1901, of which 2.6 fell in twenty-two hours; the three preceding years, added together, had yielded but little more, 1899 only 0.6 inch. Yuma has only 13 rainy days in the year, 8 of them with thunder, and a few flakes of snow are seen about once in a decade.

California has a singularly uniform type of precipitation. The greatest amounts fall in the northwest corner and the Sierra Nevada, 50 to 60 inches; the total declines

rapidly as we go southward, and becomes insufficient for agriculture at the 35th parallel on the coast and at the 38th inland. We may glance at the following table:

	January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches
South California Coast. . .	2 4	2 8	2 2	1 2	0 4	0.1	0.0	0 0	0 1	0 6	1 2	3 0	14.0
Middle California Coast . .	4 8	3 8	3 0	2 0	0 6	0.2	0.0	0 0	0 2	1 2	2 4	4 8	23 0
North California Coast . . .	7 6	6 8	6.2	4 2	2 8	1.2	0 2	0 2	1 4	2 8	5 2	7 4	47.0
Fresno.	1 4	1 2	1 2	1 2	0 4	0 2	0 0	0 0	0 2	0 4	1 2	1 6	9 0
Sacramento Valley	4 2	3 6	3 2	2 2	1 2	0 4	0 0	0 0	0 6	1 2	2 6	4 8	24.0

Seventy per cent. of the total falls during the four coldest months, practically none at all during the four warmest. The number of rainy days ranges from 35 in the extreme southwest to 130 in the northwest corner; snow is almost unknown in the lowlands, except to the north of latitude 40, where a trifle falls about once a year; in the northern high Sierra the amount of snow locally exceeds thirty feet, probably the highest figure on our continent; the reason being, of course, that most of the very heavy precipitation falls in winter. Thunderstorms are very rare, numbering only about two a year and usually occurring in winter. The local proverb, that earthquakes are more destructive than lightning, has unfortunately obtained only too ample verification.

In Lower California, as we approach the tropics, summer rains appear once more, the winter rains continue to fall off, so that the southern tip of that peninsula presents a distribution resembling that noted for Mazatlan, only in smaller quantity; exact data are not extant.

The worst feature of the otherwise magnificent climate of California is the irregularity of the winter rains. In

the southern part of the state rain falls only if the transcontinental storms are unusually severe, or take a somewhat southerly course; the feebler depressions entering the continent at Puget Sound bring little rain to the south of Point Reyes. At San Francisco the annual amounts have been 8 and 50 inches; by way of contrast, we may note that in the moderately variable climate of New York, the corresponding figures are 36 and 59 inches. The mean annual variability of the precipitation is about 25 per cent. in San Francisco, and less than 10 in New York.

In western Oregon, Washington and British Columbia, also in southern Alaska, there is some rain in summer, but the winter precipitation attains such enormous proportions that the seasonal ratio differs but slightly from that prevailing farther south. There is, however, as we go northward, a tendency of the maximum and minimum to move forward to autumn and spring respectively, so that, as we approach the subarctic regions, the type gradually approximates to that of the circumpolar region in general, as noted for Labrador and Greenland.

The following table gives details by months:

	January	February	March	April	May	June	July	August	September	October	November	December	Year, Inches
Int. W. Oregon.	6.6	5.4	4.6	3.0	2.2	1.6	0.4	0.4	1.4	3.4	4.8	7.2	41.0
Wash. & Or. C'st	11.8	8.4	8.2	7.0	4.2	3.6	1.6	1.8	5.4	7.6	11.2	13.2	83.0
Puget Sound...	6.4	5.0	4.0	3.4	2.4	1.4	0.6	0.6	2.4	3.6	6.6	7.6	44.0
Br. Col. Coast..	11.0	12.6	10.4	8.6	4.6	3.4	4.6	6.0	8.8	12.2	13.4	13.6	108.0
Sitka..........	9.6	10.4	10.0	6.2	5.0	3.6	5.2	6.8	11.2	13.4	13.6	10.0	105.0

The wettest region in North America is probably the west coast of Vancouver Island, where a three years'

record at Quatsino gives 130 inches; the Queen Charlotte Islands possibly have a similar amount; farther north, as at Sitka, there is again a gradual falling off.

The enormous totals of the winter months are quite uniformly distributed, and especially large amounts in 24 hours are unusual; the rule is an inch or two a day falls for several days at a time. The seasons vary much less than in California, and the heavy winter rains can be depended upon with perfect confidence.

The number of rainy days rises from 150 days at Roseburg to 215 at Tatoosh Island, the amount per day ranges from 0.24 to 0.45 inch, with perhaps slightly higher figures at the wettest places. The number of snowy days is only 8 to 12 in western Oregon, rises rapidly northward, but does not reach 40 even on the south Alaska Coast, for here also most of the winter precipitation falls in the form of rain. The depth of snow ranges from about a foot in southern Oregon to two feet near Puget Sound, and four or more in the north. Thunderstorms are infrequent, two or three a year; tornadoes are quite unknown.

Rain Intensity. By this term we may designate the amount of rain for each rainy day, an important matter for the medical climatologist. It may readily be calculated for each district by dividing the total precipitation by the number of wet days, but for the sake of convenience I have outlined the data in our possession on the opposite chart.

We thus readily observe the torrential character of the rains in the southeast and, to a less degree, on the North Pacific Coast, as well as the tendency to light or drizzling rains in Canada and the arid Rocky Mountain belt.


NORTHWEST PROVINCES
PACIFIC COAST
CASCADE MTS
SIERRA NEVADA
Columbia & Snake River Valleys
ROCKY MOUNTAINS
Northern Slope
Middle Slope
Southern Slope
THE GREAT BASIN
COLORADO VALLEY
Gila Valley
Lower California
THE GREAT PLAINS
MISSOURI VALLEY
MISSISSIPPI VALLEY
TEXAS
Ozark Hills
RIO GRANDE VALLEY
MEXICAN PLATEAU
LAKE REGION
Laurentian Highlands
OTTAWA & ST LAWRENCE Valley
MARITIME PROVINCES
NORTHERN & PLAIN
SOUTHERN ALLEGHANIES
OHIO VALLEY
Piedmont
ATLANTIC COAST
FLORIDA
0.4'
0.3'
0.2'
0.5'
Topographical Map of North America
Rain Intensity

CHART IV

CHAPTER III

HEALTH RESORTS

We shall find it most convenient, for practical purposes, to divide our health resorts into the two groups of North American and foreign. In considering the former, the preceding chapter relieves us of the task of stating climatological figures; we have therefore more space for other details. In the case of foreign resorts, numerical data will often be required; they are nearly all given according to Hann, our most trustworthy guide in this field; comparison with American resorts of similar type will form a conspicuous feature of this subdivision.

NORTH AMERICAN RESORTS

Greenland and Labrador. In recent years, these bleak regions have repeatedly been suggested as summer stations for the treatment of tuberculosis; the good results obtained during the colder months in temperate regions have called forth the endeavor to make them perennial, by removing tuberculous subjects to a cold summer climate, for it is notorious that the hot days of our summers are more or less injurious to them. In a recent article, Sohon[1] admits that these regions are to be considered only for the summer months; he praises them highly for their ample sunshine, even temperature, and freedom from dust and other atmospheric impurities. Exception

[1]American Medicine, April 23, 1904.

may be taken at once to the first statement; although the subarctic June day has a length of 18 hours in Labrador, and 21 in southern Greenland, so much deduction must be made for clouds and fog, that the net amount of sunshine is probably rather less than in middle latitudes. The evenness of the temperature is rather a demerit, especially when we consider that the essential principle of the cold climate treatment consists in hardening; all the arctic explorers agree in saying that they feel the chilly dampness of the far northern summer more keenly than the intense cold of winter; the very steadiness of the temperature makes the body extremely sensitive to slight changes; and the risk of catching cold is practically limited to the mild season. The summer of Greenland or Labrador does not even remotely resemble the winter on the Riviera, although the average temperature is the same.

Purity of the air is the one incontestable merit of these regions, shared, however, with most other and milder seaside resorts; it can, of course, be secured only on shore, not in the narrow and stuffy ship's cabin. In the similar summer climate of Spitzbergen a hotel has been started with some success; any permanent utilization of our subarctic regions must include some such facilities. A standing objection to this method of treatment will always be the stormy and sometimes perilous voyage to the far northern seas.

The Maritime Provinces. Eastern Canada and Newfoundland have not come much into vogue as health resorts, though the cool summer, resembling that of the British Isles, should alone be a sufficient recommendation. Nova Scotia and New Brunswick, in particular,

quite fulfill the ideal of such persons as desire a really cool summer at the seaside, with not too much wind and dampness; August and September are the best months, as fogs and rainy spells are not uncommon in June and July. The spring months are very disagreeable in the Maritime Provinces, owing to frequent changes to cold and dampness when the wind shifts to the north-east. The late autumn and the winter are subject to violent gales, with heavy rain or snow, though there are some very fine days even at those seasons.

Data have been given for a number of stations in this section; others might be mentioned, but accommodations are primitive at all the smaller and many of the better known resorts. The fare, in particular, is rarely such as would benefit an invalid, and improvement in this respect would do much to enhance the popularity and merits of this region.

The Maine Coast resembles the preceding section rather closely, but is decidedly brighter and colder in winter, and, toward the south, much warmer in summer; in Portland the heat sometimes becomes unpleasant, whereas hot weather is a great rarity at Eastport. The popularity of this coast, during the summer and early fall, is fully merited, though its climate is hardly superior to that of New Brunswick or Nova Scotia. Accommodations are, however, far better, sometimes of the first class, and this point must be allowed to weigh heavily in the selection of a health resort. The worst month in this region, as in most of New England, is April, on account of the melting of the snow and the frequent chilly northeasters from the Grand Banks.

Climatic data have been given for a number of resorts.

In addition we must mention Grand Manan, Campobello and other islands in Passamaquoddy Bay, near Eastport, but belonging to New Brunswick; Sorrento, opposite Mount Desert Island; Castine and Camden at the mouth of the Penobscot; the islands off the mouth of the Kennebec; and Scarborough Beach, Old Orchard Beach, and Kennebunkport, near Portland.

The Mountains of Northern New England. The variety of resorts in this region is very great, and the visitor may select anything from the most fashionable hostelry in a popular locality, to the almost uninhabited wilderness north of the Canadian Pacific Railway. Some sections are partly cultivated, others consist chiefly of bare or wooded mountain side, others again present a tangle of small or large lakes and streams. The free and easy type of consumptive has not yet invaded this region to any great extent, to impair it for other persons, as has happened in the Adirondacks. The higher resorts form the favorite refuge for the victims of hay-fever, who are quite sure to obtain relief at elevations above 1,200 feet.

Black flies and mosquitoes are troublesome in early summer in the heavily forested sections, but absent in the open country; malaria is unknown. The best season for children is from the middle of July to the middle of September, after which date there are apt to be heavy night frosts and some rather raw days. The winter is altogether too cold for young subjects, and exercise out of doors is greatly interfered with by heavy snow and generally bad weather; only adults should be permitted to brave this climate from November until April. The early spring is the worst season of all, on account of the slushy conditions that attend the melting

of several feet of snow, which is apt to take place very suddenly late in March or early in April, and render all the roads quite impassable.

Whole pages might be filled in naming all the available resorts. I mention only the Rangeley Lakes and Moosehead Lake in upper Maine (see Kineo in the table), Poland Springs and Belgrade in the lower levels of the same state (elevation 800 feet), the entire White Mountain and Winnipesaukee districts in New Hampshire, and practically every nook and corner of Vermont. The last named state affords about the best summer climate in the East, if not on the continent, being just comfortably cool, and neither too wet nor too dry; good accommodations are obtainable at dozens of places, too many, in fact, to be enumerated.

The Coast from New Hampshire to Long Island. We gradually leave the cool summer of the Northeast behind us, but, until we reach Boston, the temperature is still very agreeable, and prolonged hot spells are uncommon. Below Boston, we begin to note a tendency to sultriness, which increases steadily as we advance toward New York City. The situation of stations with reference to the sea breeze here becomes of importance; localities facing south or east are much cooler than such as face west or north, the latter getting a good deal of hot weather and being more or less deprived of winds from the ocean. Thus, the so-called South Shore of Massachusetts Bay is very decidedly inferior to the Cape Cod Peninsula and the districts near New Bedford and Newport; similarly, the ocean front of Long Island is preferable to the Sound front, which is again less desirable than the Connecticut Coast. Hot weather is entirely

unknown at Nantucket, Martha's Vineyard, and Block Island, but the nights are no longer very cool, so that the climate is a trifle enervating to all save young children, who often require moist and moderate warmth. The south shore of Long Island is warmer, on account of hot winds from the interior, when the sea breeze fails; there is a difference of three degrees in the average July temperature between Montauk Point and Rockaway. Malaria of a mild type occurs here and there in the marshy districts, which it is wise to avoid for this reason.

The winter grows steadily milder as we go south, becoming decidedly open, in ordinary seasons, from Nantucket to New York, where the effect of the ocean is most manifest. Here zero weather is rare, but high northwest winds and occasional severe storms are an objection that make the outer islands quite unsuitable for a winter sojourn. The proportion of sunny days is very great, and it would be worth while to try if southwestern Long Island might not rival the New Jersey Coast as a winter resort, for it is only a degree or two colder.

The objectionable east winds of spring become less serious as we advance west and south from Boston, and may be disregarded on Long Island, where the transitional month of March, with its uncertain mixture of winter and spring, is the worst of the year.

September and October are very fine in this section, although there may be some rather warm weather in the former; in southern Connecticut and on Long Island November also affords beautiful weather in many years, for the winter frequently holds off until December in these districts. November snowfalls in excess of an inch occur only about once in four years on Long Island,

and then invariably toward the close of the month. On the other hand, there is an even chance of some snow in April, which has approximately the same average temperature, for the seasons are very much retarded in this region.

From the legion of resorts we can single out but a few; namely, Portsmouth, N. H., and the Isles of Shoals, Cape Ann and the North Shore, offering a succession of first-class resorts, also no end of places in Barnstable County, Mass. The data given in the preceding chapter for Nantucket, Block Island, New Haven, and Southampton give a good idea of the climate in Rhode Island and Connecticut, and on Long Island, and an approximation to that of such places as Newport and Narragansett Pier; lack of space forbids a more detailed mention. The accommodations vary greatly, but are generally fair to good. On Long Island it will be well to avoid the proximity of the salt marshes, which begin here, and continue along most of the coast to the tropics; they invariably involve a terrible plague of mosquitoes.

The Adirondack Mountains. Northern New York has gradually become a vast sanatorium for invalids of all classes, but the unrestrained victim of tuberculosis, who roams about at will without systematic medical attendance, and often scatters infection broadcast, has begun to impair the value of this region for other persons. The climate of this section is practically identical with that of northern New England, but the choice of resorts is less varied, because of the preponderance of absolute wilderness. Such pleasant districts as the semi-cultivated valleys of Vermont are hardly to be found here, whereas the lake-strewn forest of northern Maine is duplicated on a similarly large scale, and much more accessible.

The lower elevations, among the foothills of the Adirondacks, offer the attractions of a more settled region; their situation is, however, generally somewhat low, involving a rather warm summer. Still, the low valleys occupied by Lakes Champlain and George will always prove attractive; Schroon Lake is a little higher (800 feet) and therefore cooler, and its natural beauties are considerable, but the real mountains are still many miles away.

All the remarks as to the seasons and their respective merits, that were made concerning the mountains of northern New England, apply equally to the Adirondacks. In the forested sections, comprising by far the greater part, black flies and mosquitoes are a great plague until midsummer.

Our space does not permit a recounting of the individual resorts in this region, which number scores. First class accommodations are, however, less common than in New England, and rather scattered, outside the Saranac-Placid district in the north. So far as ready accessibility is concerned, many localities are well provided for, whereas others, equally good, are twenty miles and more from the nearest railway; this may be regarded as an advantage under some circumstances, where rest and remoteness from the ordinary tourist travel are desirable.

The St. Lawrence Valley. This region is similar to the last, except that the winter becomes intensely cold. Very scant provision has hitherto been made for the health seeker, and visitors are usually taken care of in very primitive fashion. Among the few exceptions to the last statement are Roberval (Lake St. John),

Chicoutimi, Murray Bay, Quebec, Montreal, and Ottawa, but the last two are a little too warm in July and August.

Below Quebec, the river broadens out into a great gulf, and the climate is very much like that of the Maritime Provinces, with a colder winter. The lower St. Lawrence, beyond the mouth of the Saguenay, hardly comes within our ken; the climate is rather too raw for our purposes, even in midsummer. The upper reaches of the Ottawa Valley are now coming into vogue, but only for hardy sportsmen.

The Hudson and Connecticut Valleys. Along the Hudson and Connecticut Rivers we find no end of resorts, all of which are too warm for comfort in summer, and not severe enough in winter to guarantee a continuous snow covering and freedom from slushy surface conditions. As we ascend the hills on either side, both these objections disappear, and the Berkshire and Litchfield Hills, as well as the Shawangunk and Catskill Mountains, afford hundreds of attractive sites with a pleasant climate. Few climatic data are available for this region, but we can calculate the temperature of any station fairly well by taking the figures for Poughkeepsie, and deducting one degree for every 275 feet in summer, and half as much in winter; in this manner we obtain the following values for the region near the 42d parallel in the Catskills and the Berkshire Hills:

Elevation, Feet	January	July
100	24	72
1,200	22	68
2,300	20	64

In the Catskill Mountains most of the resorts lie along the Ulster and Delaware Railroad and its branches, whereas Sullivan County is threaded by the Ontario and Western line; Delaware County is reached by both. East of the Hudson there is almost an infinity of good locations along the Housatonic Railway and the Litchfield Hills line, as well as along the New York and Harlem Railroad. In the Hudson Valley itself only the Saratoga region, in its upper reaches, can be recommended, and Saratoga Springs itself is too much of a resort of fashion to commend itself for medical purposes, save in the relatively dull early summer and fall; from late July until early September it is very warm and the life there is unsuited to every sort of invalid.

The Hudson Highlands form a pretty, but, except near Newburgh, somewhat neglected hill country. The interior of Sullivan and Greene Counties, away from the railways, is ideal for restfulness, rivaling the best parts of New England. Unfortunately, the accommodations are second or third rate almost everywhere away from the main lines of travel. Malaria is unknown among the hills, not so in the lower Hudson and Connecticut Valleys.

New Jersey. Northern New Jersey, away from the suburban region near New York, resembles the last-named section, but the elevations barely reach 1,200 feet; the southern part of the state is low and flat, very warm and not over wholesome in summer, fairly mild in winter. The pine belt is well represented by Lakewood, which is to be avoided from June to September, but is highly attractive in April, May, October and November. The winter is not very mild, with a continuous variation

between snow and mud; the temperature occasionally falls near to and below zero. Up among the hills of northern New Jersey we must not fail to mention Lake Hopatcong, and the region traversed by the Greenwood Lake and Susquehanna and Western Railways.

The coast is relatively mild in winter and cool in summer, and affords at least a dozen first-class resorts, among which Asbury Park, Atlantic City, and Cape May rank deservedly high. It must, however, be admitted that the summer is not really cool; sultry spells are common, and a dozen or so of days in the nineties may be expected with some certainty; the nights are also either rather warm or marred by sea fogs. Thus, we must regard that season as decidedly enervating, and choose this section as a summer resort only because of its proximity to the great cities of New York and Philadelphia. Neither is the winter especially mild, as it averages little above the freezing point in ordinary years, and below it in cold seasons; it is redeemed only by its wealth of sunshine, equaled in these latitudes only at favored spots on the Mediterranean, which are all very much warmer. Early spring suffers somewhat from damp east winds, but is otherwise agreeable; the late fall is almost perfect, and beyond criticism, but this season is the very one in which this coast is comparatively deserted.

The inland sections of southern New Jersey are hot and malarious in summer, and colder and cloudier than the coast in winter; this region has, quite properly, received little attention from medical climatologists.

Central New York and Pennsylvania. This region presents a rolling country, with an elevation from 800

to 2,000 feet, varied at its northern edge by the pretty "finger lakes" of New York State. The data for Cooperstown and Scranton give a good idea of the temperature at the lower levels, higher localities being several degrees cooler in summer; as we go south, however, the summer becomes rather warm, and in the lowest valleys, as at Harrisburg, the winter ceases to afford continuous cold and a permanent snow covering. Cooperstown, Richfield Springs, Sharon Springs and a number of pleasant towns on the lakes represent only a portion of the great variety afforded in New York; in Pennsylvania the popular resorts are fewer, for only Cresson Springs, Glen Summit, the Pocono Mountains, and a very few other places are sufficiently high to be pleasant in July and August. The Delaware Water Gap is indeed picturesque, but the midsummer temperature there is uncomfortably high, so that this resort is better adapted to the spring and autumn.

Maryland, Virginia and West Virginia. In these states we are on the threshold of the South, and must begin to distinguish between summer and winter stations. Hot Springs and White Sulphur Springs, as well as Deer Park, are specimens of the former, a little too warm for northern visitors in midsummer, who will do better to visit them in May or October; for southerners they afford welcome relief from the humid heat of the lowlands. The figures given for Wytheville give a good idea of the temperature. Northern visitors may occasionally avail themselves of the milder stations in winter, but in general will do better by going farther south, as this season in the Virginian Mountains is decidedly unsettled and wet.

On the coast we strike the first really mild winter resort at Old Point Comfort, opposite Norfolk. Here zero is unknown, and severe cold rare, but there is still some snow and considerable frost, and the climate differs from that of Atlantic City only in being seven degrees warmer, an amount, however, worth considering, especially in the transitional months of March and April. Virginia Beach is also known as a summer resort, but only for southerners, being decidedly too warm, damp and enervating for the northern visitor.

The Lake Region. Notwithstanding its great extent, only certain portions of the Lake Region have special value as health resorts; these are somewhat scattered, and best taken up consecutively.

In the northeast corner we have the Thousand Islands, for which the climatic data for Kingston, near by, will answer very well; the summer is sometimes rather warm, but on the whole agreeable, the accommodations are of a high order. The stations on Lake Ontario take a very subordinate place; along the south shore the summer is considerably warmer than on the north shore, and the winter, while also warmer, is far more cloudy and unpleasant.

In the Lake Erie district, we may begin with Lake Chautauqua, 650 feet above Lake Erie, and, therefore fairly cool in summer; the places on the American shore of the lake are apt to be very warm. On the Canadian side the summer temperature is pleasant, but there is said to be some malaria; Port Stanley is the best known station. Near Lake St. Clair we have Mt. Clemens, famous for its springs; the climate is, however, not especially attractive, except perhaps to summer visitors from the South.

Lake Huron has the great merit of affording a cool summer nearly everywhere, except at its southern tip; a number of resorts are coming into deserved prominence, especially on the cooler Canadian side. The shores of Georgian Bay, as well as the Muskoka and other near-by lakes, are annually affording better accommodations; apart from the less rugged landscape, this section is little inferior to the lake region of Maine and northern New York, and should rival the Thousand Islands for residents of the western states, who will find it more accessible. Ample climatic data have been given, those for Parry Sound being quite applicable to the Muskoka region, save that the extremes of temperature may be a trifle greater, and the average a degree or two lower at the latter.

The Michigan side of the lake is relatively undeveloped, though it is nearly as cool north of Saginaw Bay; land breezes, however, occasionally raise the temperature into the nineties, which happens less frequently on the opposite shore.

There is an abundance of pleasant resorts along Lake Michigan, especially on the east shore, which is the cooler in summer. The finest summer climate is found near the straits, where numerous small towns afford good accommodations; the tables for Mackinaw give a good idea of the usual temperature, which is nearly the same as that of the Maine Coast; the salt air is, of course, lacking. On the opposite side of the lake we still have a fairly cool summer at Escanaba, but southward it grows warmer, though the frequent lake breezes mitigate the heat even at Chicago. The mineral springs near Milwaukee, such as Waukesha, are much frequented, but

are not cool enough to be bracing. Malaria is practically unknown in this section.

The shores of Lake Superior have hitherto not received much attention; the south shore, while generally cool, occasionally experiences some very intense heat, which is not so apt to occur in the Mackinaw district; Marquette represents this section well. The north side of the lake has so far been neglected; the summer is almost too cool at stations like Port Arthur, and other places are not very accessible; facilities for the care of tourists hardly exist on the Canadian shore. Among the hills, such settlements as White River afford a bracing summer climate, but this territory has hardly come within the scope of the health seeker.

None of the lake points are adapted to a stay from November to April, the weather is too stormy, gloomy, and changeable, and the raw winds of early spring are even worse than in New England. At favored sites, however, the month of May becomes pleasant, and from June to September the weather is good everywhere, save that midsummer is a little too warm on the south shore of Lake Erie, and in the vicinity of Chicago, which are objectionable in other ways.

The Ohio Valley. This region has little to offer in the way of health resorts; it shares in most of the disadvantages of the Mississippi Valley, to be considered later. French Lick and West Baden Springs, in southern Indiana, are much visited; their climate is a trifle warmer than that of Indianapolis (q. v.) and therefore far from attractive in either winter or summer.

The Upper South. Here we find a number of resorts worth mentioning in detail. Asheville, for which data

have been given, is the best known, and its value is not limited to the treatment of tuberculosis alone; the summer is, however, a little too warm for northern visitors, though affording welcome relief to residents of the southern lowlands. There is an occasional fall to zero in winter, with some snow, and a good deal of rain; the hills and dense forests furnish ample shelter from high winds; the whole upper South is, in fact, the least windy section in the entire East.

Hot Springs, N. C., 1,300 feet high, is a degree or two cooler than Charlotte, and therefore mild in winter, but very hot in summer. Lookout Mountain, 2,130 feet high, near Chattanooga, is a trifle warmer than Asheville, therefore generally similar, but much more exposed and hardly suited to a winter sojourn. The country about Knoxville merits a more extended trial than it has had hitherto, it lies particularly well sheltered and the temperature is fairly uniform.

All the places mentioned may safely be recommended for the spring and fall (except September). The upper South is remarkably free from malaria, considering the rather high average temperature, and presents a striking contrast to the lower South in this respect; its utilization is, however, still in its early stages, and awaits a much greater future.

The Lower South. This region can, in general, be recommended as a health resort only from November to and including April; the rest of the year is too warm, and malignant fevers are common during the rainy season from May to October, when the coast marshes have a particularly evil reputation. We shall take up the various localities from north to south.

Raleigh and Southern Pines, near by, have a winter that is still moderately cold, with some snow and frosty nights; the latter station is a little the milder and well sheltered from high winds. Aiken, S. C., and Augusta, Ga., are decidedly mild, some vegetation persisting in all but the coldest winters; still, sharp freezes are common, though snow is rare; Macon is very similar. Charleston and Savannah are not so typically urban as to be objectionable; they have the average winter temperature of southern California or Sicily, but the occasional hard frosts constitute an important difference; Thomasville is similar, but a little drier, lying well sheltered among the pines. Jacksonville, St. Augustine and Pensacola are almost subtropical, but still present all the eccentricities of the southeastern winter; Mobile, New Orleans and Galveston are similar, but a little colder, and not quite as suitable to invalids as the resorts of northern Florida; the defective sanitation of New Orleans is a standing objection to that otherwise charming winter refuge.

The entire region just outlined is better suited to the period from late February until mid-April than to the true winter season. During the midwinter months, the before-mentioned eccentricities of the southern climate have full play; the visitor suffers from a perilous and all too frequent alternation of heat and frost, the bad effects of which have already been fully considered; it is an exaggerated northeastern April that the southern winter affords us, not uniform balminess, as advertised. The effect is a mixture of pampering and hardening which is of doubtful benefit to those who are referred to this region. In spring the climate is rather good, March in Georgia resembles April in Virginia and May in New

England; the late fall should also be quite healthful in this district, but the experiment has been tried so little, that most of the resorts are not even open in November.

The Florida Peninsula. Data have been given for Tampa and Jupiter (Palm Beach); the temperature for other popular resorts, such as Miami, Ormond and Palatka, may readily be calculated from those mentioned; it remains for us to generalize. The first common mistake is to speak of Florida as if it had one climate, whereas the winters of Jacksonville and Key West differ by 15 degrees, and the average minimum temperatures by almost twice as much. At the former place January resembles late April and early May in New York, save for hard frosts that are more appropriate to March than May; at Key West we have the climate of the New York June, though occasional chilly spells occur that have no counterpart in the northern month of roses.

The second mistake is to put off the southern tour to the latter part of the winter, say February, and then transport the invalid from Boston or Chicago to Palm Beach or Miami, which are forty degrees warmer, without breaking the journey. Some days after arrival, when the process of enervation is fairly started, the visitor is surprised by a norther, with a temperature near the freezing point, and runs at least an even chance of catching a severe cold. An "unusual" season—the ordinary mixed-up weather of the Florida winter is always called "unusual" for the benefit of visitors—is apt to leave the patient worse off than before. Fortunately, a wise custom postpones the return north until late April or May, and accomplishes it gradually; to take the enervated subject at once back to Boston in the

inclement weather of early spring would undoubtedly involve disaster in many a case.

The third error, a common one, consists in keeping the patient in the increasingly warm and moist climate of south Florida until the fashionable season is over, in mid-April. Enervation is the chief danger to be apprehended, it is quite certain to be accomplished by a prolonged residence in this region. For this reason, the absolutely tropical, yet changeable, winter of Key West and Havana is to be avoided altogether; the latter city has a number of other drawbacks that need not be gone into here.

There is a vigorously defended tradition that malaria is less frequent in Florida, than farther north; this may be true for the Atlantic Coast, with its trade winds, but it certainly does not apply to the West Coast during the warm months, where such places as Tampa have an unsavory reputation. The excessive humidity alone is extremely depressing to any one not a native; this forms an objection to southern Florida even in winter, the dry season. On the whole, this region cannot be compared with southern California, or even the western Riviera, as a winter health resort; its chief merit is its relative accessibility, and its luxurious accommodations for visitors.

On the whole, it is probable that the upper South is often to be preferred to the lower South, and this in turn to Florida, in the treatment of disease; this rule, naturally, admits of many exceptions, but I am convinced that longer experience, even with children, will eventually bear out this statement.

The Bermuda Islands. What has been said of Florida

applies equally to the Bermudas. There is, indeed, a lack of the sudden and trying changes that characterize the former region, but the process of enervation is thereby only the more thoroughly accomplished, and it is worth mentioning that this result of a stay in the Bermudas has always been recognized as a serious demerit. The Bermudas have a certain therapeutic value, but their climate is a less important factor in their usefulness than their remoteness from the ordinary highways of commerce.

The Mississippi Valley. This region is of little value for our purposes. The winter is about the most changeable in the world, and grows quite insalubrious toward the south, where the frequent warm and humid spells add the danger of enervation; the more severe but less interrupted cold of Minnesota and Iowa is far safer. The summer is hot everywhere; malaria is rife as far north as Illinois and Iowa, and the malignant types of fever are not rare in the river bottoms, though this last circumstance is not often referred to in print.

Almost the only health resort in all this vast district is Hot Springs, Ark., where the climate is really pleasant only in spring and autumn. The elevation of this town is 480 feet, and the data given for Little Rock, near by, give a very adequate idea of the climate, the winter being quite cool and very changeable, the summer intensely hot.

The Great Plains. When the Great Plains were first settled much was said about their remarkable salubriousness, but we hear little of that to-day. The Canadian Northwest, however, is bracing and healthful, if one can endure the terrible cold of the long winter, which has the

compensating feature of being fairly bright and sunny, free from rain, mud and slush, and with a moderate snowfall that lies on the ground until April. The summer temperature is, on the whole, quite agreeable; the occasional very hot days are tempered by a low relative humidity and frequent refreshing showers, and the nights are quite uniformly cool.

Some of the merits of the Northwestern Provinces of Canada are shared by North Dakota and eastern Montana, but the summer heat here is occasionally very intense; farther south, the climate has few attractions. The extremes of temperature are felt most severely, the high winds are exceedingly trying, and the low humidity acts chiefly by increasing the amount of dust. The scorching blasts of summer, the blizzards of winter, and the constant peril from tornadoes from April to August do not contribute to the otherwise scanty climatic attractions of this section which, all in all, is one of the worst on the continent for neurotic persons. The dryness, furthermore, is not sufficient to afford protection against malaria, which begins to be of moment in Nebraska, and becomes a serious evil in many parts of Oklahoma and Texas. In the last-named state the summer ceases to be really dry, owing to the predominance of the Gulf winds at the season named, and the climate becomes extremely unwholesome in the river valleys.

The Rocky Mountains. We must consider the Rocky Mountains with some little minuteness, if only because of the great variety of health resorts that they afford; in this respect they are perhaps destined to surpass any other portion of the continent. In the following account we shall again stop at the 37th parallel, for the Southwest,

while not inferior, presents conditions so different as to call for separate discussion.

In the Canadian Rockies, the summer is rather cold, but the winter is not unduly severe for the latitude and elevation, save on rare occasions, when the thermometer may fall to 30 or 40 degrees below zero. The Canadian Pacific Railway has done much to furnish quite good accommodations in this section, which resembles the Swiss Alps in scenery and climate; the data for Banff give a good idea of the latter.

In the United States the eastern slope still has a rather changeable winter, but the average is relatively mild; the winds are less violent than on the plains, with the exception of the warm and very dry Chinook; there is usually little snow, and a low humidity, but the clearness of the sky has been overstated, except for southern Wyoming and Colorado. Spring is the least pleasant season, being relatively, but only relatively, moist, cloudy, and rainy. The summer is bright, with rather hot days, and very cool nights, occasional thunderstorms in the afternoon, and a very low humidity, which makes even 95 degrees in the shade tolerable. The fall is delightfully bracing, with warm clear days, and frosty nights, merging almost imperceptibly into winter. Ample tabular data have been given, and we need only mention that the best accommodations are offered at Helena, Denver, Manitou and Colorado Springs, whereas at most other places, otherwise quite as desirable, they are apt to be primitive.

In among the mountains there is a little more moisture, and some situations are fairly well forested. Good accommodations are obtainable in the Yellowstone Park

—rather cold and open only in summer—Glenwood Springs, and Ouray, Col.; elsewhere they are usually primitive. Leadville is too high and cold for most people; snow falls there even in midsummer; at Grand Junction the summer is rather hot.

In the Great Basin the climate is somewhat different; the winter is not so very bright, and brings some rain and snow, this weather continuing until late spring; the summer is warm, with almost uninterrupted sunshine; the autumn is like that on the eastern slope. An objectionable feature is the barrenness and dust in summer; the heat is rendered endurable by the extremely low humidity, but more rain would be welcome. High winds are a trying feature in exposed situations, as at Carson City and Winnemucca; they are not intolerable at Salt Lake City, where alone there are ample accommodations. Data have been given for the places mentioned; the even temperature in western Nevada is worthy of note, also the usually steady winter temperature everywhere, in marked contrast to the thermometric oscillations of the entire east, including the slope.

The relative warmth of the Snake River Valley was noted in the preceding chapter; the summer is, however, too dry to be oppressive; the winter is wonderfully mild for the latitude, but rather cloudy, though not very wet.

The Southwest. Here we shall merely endeavor to amplify our tabulations. In northern New Mexico we have Santa Fé and Las Vegas Hot Springs, with temperatures that rarely go beyond zero and 90 degrees, a dry winter, and a summer that is also dry, but nevertheless has abundant showers. Albuquerque is mild in winter, a little warm in summer, accommodations are not very

good; the last is also true of El Paso, where the summer is uncomfortably hot, in spite of the low humidity. Silver City has become a popular health resort, the climate being very equable.

In Arizona we have a great variety of climates. Yuma and Phœnix afford one of the best warm and dry winter climates known; with a mean temperature resembling that of Jacksonville and Charleston, and a much greater daily range, they are still far less liable to sudden changes and hard frosts. Their summer, however, is intolerably hot, and the humidity in July and August is not especially low, so that the heat is quite unendurable. Tucson has a similar climate, but slightly cooler at all seasons; the deserts of southeastern California are uninhabitable during the warm months. None of these places except Phœnix have really good accommodations.

In the uplands of Arizona we find a pleasantly cold winter, with some sharp weather, but very little snow, and in summer moderately hot and dry days, with occasional showers, and cool nights. Prescott offers fair accommodations, and there is now a good hotel at the edge of the Grand Cañon; most of this fine district, however, is for the present undeveloped.

The Mexican resorts on the plateau must not be forgotten; unfortunately the accommodations for health seekers, except in the capital, are rudimentary, and the City of Mexico, in spite of a good climate for such as can stand the altitude, is objectionable from other points of view. The tables given in the preceding chapter are amply sufficient for conveying an idea of the climate on the plateau, with its charming winter and only moderately hot summer. The dry season lasts from October

to April or May; moderate rains fall during the rest of the year, and even the rainy season has plenty of sunny days. There is a promising and still almost virgin field for enterprise in the highlands of Mexico, as well as in our own Southwest.

We may now pass on to the Pacific Coast districts, which include so many very different climates that we are obliged to make a number of subdivisions.

Southern California. The southwestern corner of California has probably the finest climate in the world, with only a tendency to drought to set against its many merits; ample tables have been given to illustrate such matters as can be reduced to figures, but a few additional remarks are necessary for a complete description. The summer temperature varies exactly according to the distance from the California Coast Current; Santa Catalina Island having a perpetual spring, Santa Barbara and San Diego a few hot days, Los Angeles and Pasadena some intense heat when the desert wind blows, fortunately with a low humidity; at San Bernardino and Riverside the summer, in general, is a little too warm for real comfort, though the nights are still cool. After crossing the Coast Range the heat rapidly becomes intolerable, quickly increasing as we descend into the desert. In winter all this is changed, and the temperature is a trifle higher on the coast and islands than inland, declining with the elevation in the usual way. Temperatures below the freezing point are very rare on the coast; inland 25 degrees are recorded on some occasions, but only the tenderest vegetation is likely to be injured. In summer, the afternoon fogs are apt to be annoying, but they are less frequent than farther north, and are attended with

less violent west winds. The best season is unquestionably from December to May, the defects of the summer have been mentioned, the autumn has some hot days, even so late as November and, generally speaking, the only rather unsettled weather of the year. No other region affords an equal number of days suitable to outdoor life, and in wealth of sunshine this strip of country is little inferior to the desert itself. The winter is an almost perfect reproduction of October in southern New York and New England.

All the places mentioned offer good accommodations, and there are others, excluded only from lack of space. Not the smallest merit of this region lies in the fact that malaria is unknown, in marked contrast to places in the Old World having a similar climate.

Central and Northern California. In this region we encounter a number of widely different climates, which must be discussed separately. The coast of middle California is delightful in winter, almost equaling the southern resorts; Monterey is the favorite, but Santa Cruz is not inferior. In summer, however, the coast is damp, foggy and windy, and best avoided by all save the very robust; there are some hot days in May, June, September and October, rarely in midsummer, when the sea breeze is unpleasantly strong and constant; the best season, therefore, is from November until April or May.

The interior is a little cooler in winter, with some frost, and rather more cloudy weather than on the coast, a common phenomenon, as already observed; the summer is almost absolutely cloudless and very warm, the heat increasing as we go farther from the Golden Gate. Even the low humidity does not compensate for the high after-

noon temperature, although the nights are generally comfortable. The peculiar distribution of temperature about San Francisco has already been fully described.

The North California Coast only remotely resembles that farther south; the temperature in winter is only a few degrees lower, but there is an excess of rain and storms that makes this season disagreeable; the summer is even damper than that of San Francisco, which is saying all that can be said; the climate cannot be recommended at any season, and the very equable temperature does not atone for the exceedingly disturbed condition of the atmosphere at nearly all times of the year; only the autumn is a little better in this respect.

The very pleasant and bracing climate of the mountain region of northern California has barely been utilized. The winter is not really cold at ordinary elevations, but there is a good deal of rain and some snow; the summer is fine, not too warm, but a little too dry, and a few showers would be an improvement. In the wonderful coniferous forests, however, the dust is not so objectionable as it is, to a distressing degree, in the Californian lowlands.

Oregon and Washington. The coast of these states has the defects of that of northern California, plus an even more rainy and stormy winter, with occasional hard frosts; the Coast Range here is not high enough to afford perfect protection against the cold waves coming from the interior; and east winds are altogether commoner here than in California. The interior has a climate closely resembling that of southern England and northern France, but very much finer in summer, when a rainy day is rare. The summer is also very dry, though

not to the degree encountered in California, and the sensible temperature is low, with very cool nights. Many of the small towns of this region offer very good accommodations, and even the cities are less objectionable than in the East, especially as they are mostly of only moderate size. Olympia is perhaps the best situated of all, as it lies well sheltered, the other places on Puget Sound are a little too much exposed to the winter storms; in Oregon such places as Salem (near Portland) and Roseburg may be recommended with confidence.

Behind the Cascade Mountains the climate differs radically, and partakes of the characteristics of the Great Basin, with a moderately cold, but not too changeable winter, which brings some rain and snow, and a very dry and warm summer, not very different from that of the interior of California, but some degrees cooler. Walla Walla is typical of this region, Spokane is higher and farther north, and has a most agreeable summer; the region about Baker City is still higher, and cooler in summer; but offers no accommodations to speak of.

The North Pacific Region. Outside of the section near to and including Vancouver Island, the coast has nothing to offer the health seeker, as the climate is raw, though not really cold, throughout the year. The section mentioned, however, offers fine and cool summer quarters at Victoria and New Westminster, far superior to what one would expect in this rather remote portion of the globe.

The interior of British Columbia is *terra incognita* to the medical climatologist, chiefly because of its remoteness from our great centers of population. In the up-

lands the climate is alpine, with moderate extremes of temperature and deep snow in winter, the summer being exceedingly pleasant and bracing. The lowlands vary greatly according to situation, for the amount of moisture declines rapidly as we approach the mountains, but the temperature is moderate everywhere, save for some hot days below Kamloops, and an occasional spell of zero weather in winter. I have already given the tabular data that are most trustworthy; they are here presented in convenient form for the first time, and may encourage experimentation with this decidedly healthful region.

Alaska is either too wet or too cold for the health seeker, and need not detain us. For the present there are no accommodations for travelers except aboard the tourist steamers, but certain classes of neurotic invalids may be benefited by the popular Alaska tour, on which storms are not likely to be troublesome, as the course of the steamers lies behind the islands along the coast. The best and least rainy season embraces June and July, sometimes August is also pleasant; at other seasons torrential and continued rains may be expected with certainty.

A CLIMATIC CLASSIFICATION OF AMERICAN RESORTS

There is some advantage in classifying the American resorts along the lines laid down in the first chapter; while necessarily somewhat of a jumble of heterogeneous elements, such a list will still be of use as a general guide.

A. Hot and moist. The Florida Keys, the Bahamas, the West Indies.

B. Warm and very moist. The immediate coast from

Charleston, S. C., to the Rio Grande and beyond, the Bermudas.

C. Warm and moderately moist. The inland strip immediately adjacent to the above, the remainder of Florida, southeastern Texas, southwestern coast of California.

D. Warm and dry. Southwestern Texas, the Mexican Plateau, the hill country of southern California.

E. Warm and desert-like. The arid belt from Phœnix, Ariz., to the San Bernardino Range in California.

F. Very temperate and very moist. The California coast from Santa Barbara to San Francisco, also the islands off southwestern California.

G. Very temperate and moderately moist. From the preceding inland to the Coast Range.

H. Warm temperate and very moist. The Atlantic Coast from Cape Hatteras to Charleston.

I. Warm temperate and moderately moist. The Gulf States except as noted in B and C, and the lowlands of South Carolina and southern North Carolina.

J. Warm temperate and dry. The moderate elevations from central Texas to the Mojave Desert, the Great Valley of California.

K. Middle temperate and very moist. The coast from Cape May to Cape Hatteras.

L. Middle temperate and moderately moist. The lowlands from St. Louis and Cincinnati to Memphis and Chattanooga; the Piedmont from Washington, D. C., to Charlotte, N. C., southern Missouri, Arkansas and Oklahoma.

M. Middle temperate and dry. Southwestern localities between 3,000 and 4,500 feet. Very few stations come under this head.

N. Cool temperate and very moist. The coast from Portland, Me., to Cape May.

O. Cool temperate and moderately moist. The lowlands of New York and New England; Pennsylvania, except the highest hills; interior New Jersey; the southern Alleghanies up to 2,500–3,500 feet; the Lake Region from latitude 43.5 southward, thence to Cincinnati and St. Louis; the upper Mississippi Valley, South Dakota, Nebraska and Kansas to the 100th meridian; eastern Washington and Oregon up to 2,500–3,500 feet (the last are dry in summer).

P. Cool temperate and dry. The Rocky Mountain Slope and Great Basin, the mountains themselves up to 7,000 feet in the south and 3,000 feet in Montana, the lowlands of interior British Columbia.

Q. Cool and very moist. The coast from Newfoundland to Portland, Me., and from San Francisco to Alaska.

R. Cool and moderately moist. The upper Lake Region, North Dakota, nearly all of Canada, the higher Alleghanies from 1,000 feet in New England to 3,500 in North Carolina, upward.

S. Cool and dry. The higher Rocky Mountains to the tree line.

T. Cold and very moist. Greenland and the Labrador coast.

U. Cold and moderately moist. All the mountains above the tree line and subarctic Canada.

FOREIGN RESORTS

In considering foreign resorts no attempt will be made to cover the ground completely, but only such

regions will be dealt with as come within the ordinary scope of the American practitioner. Three groups interest us chiefly, namely, the coast of western Europe, the mountains of central Europe, and the Mediterranean Region.

Western Europe. Western Europe affords a wide range of moist climates, which are the mildest in the world for the latitude, with a most even temperature, and certain conspicuous advantages even over our Pacific Coast. They all have the merit of being more conveniently accessible from our eastern cities, for, to only a passably good sailor, the transatlantic voyage is in many ways pleasanter than the four days' railway journey to the Pacific. Accommodations, furthermore, are almost universally excellent in western Europe; as much can be said only of certain especially popular resorts on our continent, the fare, in particular, being too often unsuitable to an invalid at places affording a most attractive climate.

Norway and Sweden are known to Americans chiefly through the popular trip to the North Cape, which involves a rather rough voyage that unfits it for delicate persons. The inland stations of this attractive section, almost ignored by the medical climatologists, afford a summer that is not very different from that of eastern Canada, cool and bracing, with some twenty hours of daylight, but perhaps a slight excess of moisture. The remoteness from fashionable life constitutes a valuable asset and makes one wish that this region be made the subject of further study.

A few temperature data from this section will no doubt be welcome:

	Feb.	April	July	Oct.	Year	Average Max.	Average Min.
Norway { Hammerfest....	23	32	53	35	35.4	75	6
Norway { Bergen.........	34	42	58	45	44.6	79	12
Sweden—Stockholm......	26	37	62	43	41.5	88	−6

Autumn is the rainiest season on the west coast of Norway, elsewhere most rain falls in summer. Bergen is one of the wettest stations, with 74 inches annually; but many parts of the interior of Norway and Sweden have less than 20 inches. The climate of Bergen is almost an exact reproduction of that of Sitka, Alaska, but Bergen is three degrees farther north, and about two degrees warmer.

The British Isles. We find a wonderfully even climate on the western and southern coasts of Great Britain and Ireland, whereas the interior and eastern portions of Scotland and England present more variable and extreme conditions. We may begin by glancing at the temperatures for the five cold months at the most favored stations:

	Nov.	Dec.	Jan.	Feb.	Mar.
Valentia, Ireland.............	48	45	45	45	46
Penzance, Cornwall...........	48	46	45	46	47
Jersey, Channel Islands.......	47	44	43	44	45
Ventnor, Isle of Wight........	46	43	42	43	44

These stations not only have the temperature of central Italy, but more sunshine than other points in Britain; the latter is not, however, saying a great deal, and Jersey, with 1,800 hours of sunshine per year, is still as cloudy as the south shore of Lake Ontario, and very far indeed behind the least sunny Mediterranean resorts.

The minimum temperatures at these favored stations are remarkably mild. At Valentia the average annual minimum is 29 degrees, the record is 21; even for Ventnor 26 is reported as the mean minimum, and the same figure applies to the Channel Islands. The vegetation of these sections is mixed with subtropical forms, originally introduced, but now naturalized; snow is quite an exceptional phenomenon.

The summer temperature of Great Britain and Ireland varies chiefly according to the latitude, but is a little higher on the east coasts and inland. It barely touches 60 in interior Ireland or the south of Scotland in July, but reaches 61 to 62 in all the southern English counties, including the Channel coast and islands. In northern Scotland it drops to 56, and on the Shetland Islands to 53.

Storminess is the main defect of the British climate, but from April to August the weather is relatively quiet. Fogs are exceedingly common, but not worse than on our extreme northeastern and northwestern coasts; the black fog of the English and Scottish cities is a local affair, as already explained.

For the sake of completeness I give temperature data for the three capitals.

	Jan.	Apr.	July	Oct.	Year	Average	
						Max.	Min.
Edinburgh	37	45	58	47	46.8	—	—
Dublin	40	47	60	50	49.1	76	23
London (Greenwich)	37	47	62	50	49.1	87	17

The absolute extremes at Greenwich for a very long period are 97 and 4 degrees. London has very nearly the climate of Seattle, but the summer is rainier, the wet

season also coming on somewhat earlier, and lasting from August to January, with a fairly dry spring. The east of England has only 24 to 30 inches of rain, falling on about 180 days, so that a drizzle is commoner than a heavy downpour; in the Scottish Highlands and in Cumberland we find over 100 inches per annum, and in autumn these districts are fairly drowned in torrential rains.

Save for the extreme south, Great Britain is only to be regarded as a summer resort, and even then, as just stated, there often is an excess of moisture. The spring is considered unwholesome, on account of the frequent east winds which, coming from the continent, are relatively dry; it is doubtful if they can be regarded as injurious to Americans, who are used to a drier climate. The average annual humidity in the center of England (Oxford) is 80 per cent., 86 in early winter, 74 in late spring; the last may seem dry to an Englishman, it certainly would not give us that impression.

The German Coasts. An abundance of climatological material is furnished from the coasts of Germany. Along the North Sea we have the following temperatures:

	Jan.	April	July	Oct.	Year
Helgoland	34	43	62	51	47.3
Sylt	33	44	62	49	46.9

The winter is colder than in Britain, the summer very slightly warmer; there is a good deal of very bad weather from October to April; 11 inches of rain are spread over the winter and spring, and 16 over the summer and autumn.

The Baltic Coast is much colder in winter, but hardly warmer in summer:

	Jan.	April	July	Oct.	Year
Putbus (Rügen)	31	42	63	47	45.5
Swinemünde	30	43	63	48	45.7

The Baltic resorts are generally preferred by the Germans, as there is practically no tide or surf; but the water is only brackish, not really salt. The winter climate is decidedly gloomy, raw and disagreeable, but the summer is rather pleasanter than on the North Sea. More than a third of the precipitation falls in summer, the minimum is from January to April, about a fourth of the total in all; the autumn is much damper than the spring, as on all northern coasts.

Americans rarely have occasion to visit these shores, as our own northeast affords a similar temperature with less storminess.

The Atlantic Coast of France has quite a uniform climate, in spite of the differences in latitude; the only general change from north to south is a decrease of cloudiness. We may begin with a table of temperatures and include therein the coast of the Netherlands and Belgium, which is similar, though somewhat colder.

	Jan.	April	July	Oct.	Year	Average	
						Max.	Min.
Ostende	36	47	63	51	49.2	—	—
Brest	43	52	64	54	53.0	90	24
Biarritz	45	54	67	58	55.8	98	23

Note that the minima are lower at Biarritz than at Brest. The former place is, all in all, perhaps the best on the French coast, being relatively sunny and not very

stormy. The distribution of rainfall is pretty uniform on these coasts, but with a slight excess from September to January, and a moderate summer minimum southward; the total exceeds 70 inches in the southwest corner. The relative humidity is high, 76 per cent. in spring and 83 in autumn, in spite of occasional dry and warm "foehn" winds.

To complete the picture, I give a few temperature data from the interior of France:

	Jan.	April	July	Oct.	Year	Average	
						Max.	Min.
Paris (suburban)........	36	49	65	50	50.2	93	12
Lyons (C).............	36	53	70	53	52.7	—	—

In central France some 30 inches of rain are quite evenly distributed through the year, save for a slight minimum in March and maximum in May. Temperatures above 95 and near zero are not so very rare.

The North and West Coasts of Spain and Portugal have a climate something like that of our Pacific Coast. Along the Bay of Biscay we are reminded of southern Oregon, farther south the south California coast is recalled, so great is the similarity in almost every detail, as to both temperature and the distribution of moisture.

The following table will suffice to indicate the temperature of this section:

	Jan.	April	July	Oct.	Year	Average	
						Max.	Min.
Oviedo (700 feet)........	43	54	66	56	54.5	91	25
Lisbon	51	58	71	62	60.1	96	35

Lisbon closely resembles Los Angeles, but is somewhat moister, with less intense hot winds in summer: 29 inches of rain fall annually, 12 in winter and only 1.5 in summer. At Oviedo 36 inches fall in the course of the year, 13 in winter and 4 in summer; here it snows a few times nearly every winter, whereas in Portugal snow is very rare in the lowlands.

It is a pity that accommodations in Portugal should be generally so primitive as to bar out health seekers from perhaps the finest all around winter climate in Europe.

The Azores and Madeira. Here the Portuguese type of climate is intensified, and the variations of temperature become very small, as shown in this table:

	Jan.	April	July	Oct.	Year.	Average	
						Max.	Min.
Azores	57	59	71	65	63.0	80	43
Madeira	60	62	72	68	65.5	85	49

Frost is unknown in the lowlands, and the absolute minimum at Madeira is 44 degrees, 91 being the record in summer; visitors complain of the hot winds, but they cannot be unbearable under the circumstances, especially as they are notoriously dry.

The Azores are too windy to be ideal for many patients, and both groups are decidedly enervating, except from October to May. On the Azores we find 36 inches of rain, 13 in winter and 4 in summer; on Madeira 27 inches, 13 in winter and none from May to September. Madeira has a remarkably low humidity, 65 to 70 per cent. throughout the year; the proportion of cloudiness is also moderate, and fogs are not very common.

The Pyrenees. The Pyrenees are most conveniently

considered here, though their climate resembles that of central Europe in many respects. Only the French side offers a sufficiency of good accommodations; the southern slope, which probably affords a better winter climate, is relatively undeveloped, though some mineral springs of the first rank are to be found there. Unfortunately we have but few climatic data from this region; Pau, at 700 feet, has a mean January temperature of 42 degrees, with an average minimum of 20; the humidity is about ten per cent. lower than at Biarritz. The rainfall in this region ranges from 50 to 80 inches, with maxima in spring and autumn.

It will be seen, from the above, that the French Pyrenean climate is cool and moist in winter, mild and often very wet in spring and autumn; the Spanish side is much drier, and among the foothills, quite extreme. I have not been able to find any thermometric data for the summer, but the average for July, at 1,500 feet, is about 68 degrees in the west, rising gradually eastward to about 72 near the Mediterranean; the latter section is very little visited, compared to the reglon about Pau and Tarbes.

Central Europe. The hill and mountain country of central Europe has deservedly become the world's favorite playground and health resort. Its natural advantages, only in part climatic, have been enhanced by artificial improvements and no little governmental aid, and the visitor is made comfortable in ways of which American resort boomers know only the veriest rudiments. Excellent roads, shady and smooth paths, cleanliness and good food at all prices, first-rate medical

attendance, and a most ingenious development of every little factor that can contribute to health and enjoyment, have been held out to the traveler in the most tempting way.

South and Middle Germany consist almost wholly of country resembling our Alleghanies; mountains from three to five thousand feet in height alternate with pleasant river valleys and interesting old towns. The climate is similar to that of our northeastern hills, but is a little cooler in summer, and decidedly milder, though more cloudy, in winter. I give a short table:

	Elev.	Jan.	April	July	Oct.	Year	Average	
							Max.	Min.
Harz Mountains......	2,300	27	39	57	44	41.5	86	−4
Black Forest......	2,600	28	43	60	44	43.6	86	−5

Some of the chief towns of Germany are given here for comparison:

	Elev.	Jan.	April	July	Oct.	Year	Average	
							Max.	Min.
Berlin (suburban) .	150	31	46	65	48	47.3	91	2
Frankfort a.M.......	300	32	49	66	49	48.6	92	4
Munich...........	1,750	27	45	63	46	45.0	87	−1

Note the cool and rather extreme climate on the Bavarian plateau (Munich); in marked contrast thereto is the high temperature of the upper Rhine Valley:

	Elev.	Jan.	April	July	Oct.	Year	Average	
							Max.	Min.
Heidelberg........	400	34	50	66	50	49.8	91	6

The rainfall in South Germany ranges from 25 inches on the upper Rhine to over 50 in the mountains; one-third falls in summer, half as much in winter, with the other seasons exactly intermediate. The colder sections

are usually covered with snow for two or three months, in the warmer localities the snow covering is intermittent, because of the high mean temperature; the winters vary exceedingly in this respect.

Save for the successful treatment of tuberculosis at Goerbersdorf (1,800 feet), Silesia is almost unknown to American climatologists. The mean temperature at this resort is 28 degrees in January, 42 in April, 61 in July, and 44 in October, the year averaging 43.4. The climate is therefore much milder than in the Adirondacks at the same level, except during the summer, when it is a few degrees cooler. On rare occasions, the thermometer falls as low as −20 in the Silesian hills; it rarely rises above 90. The distribution of moisture is exactly the same as in western Germany.

Bohemia has a number of very excellent and popular resorts in its northwestern parts. The representative town of Carlsbad (1,200 feet) has the following temperature:

January, 28; April, 46; July, 65; October, 47; year, 45.7 degrees.

The distribution of moisture remains the same as for Germany.

The Northern Slopes of the Alps have similar temperatures, save in certain valleys trending northward, where the colder months, as at Altdorf, are materially warmed by descending foehn winds; the following table gives a few data:

	Elev.	Jan.	April	July	Oct.	Year	Average	
							Max.	Min.
Zurich, Switzerland	1,550	29	48	65	47	47.3	87	7
Altdorf, "	1,500	32	49	64	49	48.4	86	12
Innsbruck, Austria	2,000	26	48	64	49	46.4	—	—
Vienna (suburban), Austria	750	29	49	67	50	48.4	92	6

The distribution of rain is the same as in south Germany, with a slight increase in summer, and decrease in winter.

The Alpine Plateau, being shut in by mountains, does not obtain the benefit of the inversion of temperature in winter that characterizes the peaks and their slopes; its temperature is therefore low throughout the year. The winter resembles that in the Adirondacks, but is not quite so cold or nearly so changeable, and temperatures under −20 are quite rare. The summer is cold, almost arctic, with occasional frost and even snow; the weather at that season is, in fact, altogether autumnal, and by the end of October winter resumes its sway. The worst month in this region is April, when the accumulated snow of winter melts with some rapidity.

The following table gives the temperature at some well-known resorts:

	Elev.	Jan.	April	July	Oct.	Year	Average	
							Max.	Min.
Davos, Switzerland	5,300	19	36	54	38	36 7	—	—
St. Moritz, "	5,900	17	33	52	36	34 7	72	−8
Upper Tyrol, Austria	4,800	19	36	53	38	36 4	—	—

The humidity at Davos is 82 per cent. in winter, and 74 in spring and summer, and the climate is therefore quite moist, even more so than that of our northeastern mountains. Two-fifths of the precipitation fall in summer, only one-sixth in winter; the total snowfall amounts to about ten feet.

The Southern Slope of the Alps, sheltered by the exceptionally steep declivity to the north, is relatively very mild, milder than the lowlands of northern Italy. This region affords some of the most desirable spring and

autumn resorts in the world, and even in winter the sheltered situation of these retreats gives them a high rank. The average temperature of this section somewhat resembles that of the southern Alleghanies, but the weather is far less changeable, and zero is almost unknown. The following tables will furnish very ample details:

	Elev.	Jan.	April	July	Oct.	Year	Average	
							Max.	Min.
Montreux, Switzerland	1,300	33	49	67	50	50.2	83	15
Lugano, "	900	34	52	71	53	52.3	89	20
Meran, Austria	1,100	33	55	73	54	53.6	91	17
Riva, "	300	37	55	74	57	55.4	—	23

Pallanza, on Lake Maggiore, has a mean temperature of 37 degrees in January, and Bellagio, on Lake Como, averages 38; the respective minima are 21 and 22; the lowest temperature at Lugano in fifteen years was 12 degrees; in summer temperatures over 90 are quite common on the Italian lakes. The monthly range at Meran, in winter, is only 30 degrees, the same as at Cannes, and 6 less than at Pau. This region, therefore, affords a rare example of a moderately cold but very steady winter, in which it differs strikingly from anything known in the United States.

Before leaving the Alpine region, we may review a few general matters. Zurich and Berne have only 1,760 hours of sunshine annually (40 per cent.), Montreux, on the southern slope, has 1,930 (44 per cent.), and Lugano 2,250 (50 per cent.). In January the sun shines four hours per day at Lugano and only eighty minutes at Zurich; in July the respective figures are nine and a half and eight. The plateau makes a better showing in winter than the northern slope, for Davos has a daily

allowance of three hours in January; in summer, however, the proportion of cloudiness is a trifle higher on the plateau.

The distribution of rain on the southern slope of the Alps is no longer exactly the same as farther north: the amount is relatively great, for the warm southerly winds condense their moisture on striking the mountain wall. Of the average total of about fifty inches, 15 fall in summer, and the same in autumn, only 8 in winter. The autumn rains are the first step in the transition to the Mediterranean region, where heavy October and November rains prevail throughout.

In closing our survey of this section we must not fail to call attention to the accessibility of the hundreds of good resorts within this region, and the universally excellent accommodations to fit every purse. In the latter respect it is to be regretted that American enterprise has hitherto proved sadly remiss; single cantons of Switzerland contain more good hotels than the whole Alleghany Mountain region, and the accommodations offered in this country to persons of moderate means are usually inferior, the table especially being unsuited to individuals whose health is impaired. Another defect of American resorts is the absence of good paths, with easy grades, and in most cases, good roads for driving. The author, having an intimate personal knowledge of the mountain resorts on both sides of the Atlantic, experiences no feeling of astonishment at the enormous annual exodus of American tourists and invalids to the health resorts of Europe; the trials of the ocean voyage are more than compensated by the better care obtainable on arrival.

One of the defects of the climate of central Europe is the variability of the seasons, which equals that in the Rocky Mountains, and makes it impossible to promise the visitor anything like the normal conditions. Especially is this the case in winter, when the weather in the Rhine Valley, for example, may be as cold as at St. Petersburg or as warm as at Florence. Meanwhile the daily variability is barely one-half of that in the eastern United States; here the advantages of the European climate are conspicuous, sudden changes are indeed rare; a change of 20 degrees from day to day occurs only once in three winters in central Europe, six times in each winter in the eastern United States, and oftener in the middle West.

Throughout central Europe the percentage of humidity is about 80 to 85 in winter, and 65 to 75 in summer; it is always low during the infrequent hot spells, when the daily range, even in the cities, exceeds 30 degrees. The nights are therefore cool in the warmest weather, a minimum as high as 70 degrees being phenomenal, whereas this is the July average in the warmer American cities. Heat-stroke is therefore very rare in central Europe, though the maximum temperatures differ but slightly from ours.

The Mediterranean Region. Here we begin the study of a territory that offers a range of climatic attractions unrivaled on the globe. Only a small strip of North American soil, two to three thousand miles from our great centers of population, has a climate of similar type, and for extent, variety, luxuriance of vegetation, and facilities for the traveler, the most favored Mediterranean

resorts have a rival only in one small corner of our Pacific Coast, embracing at the most 10,000 square miles, just equal in area to Sicily.

Spain. But for generally primitive conditions, the Mediterranean shores of Spain would rank high among health resorts; as matters stand, only Gibraltar and Malaga can be recommended. Valencia and Barcelona also afford a pleasant winter climate, but the health seeker is treated better at other places that are quite as salubrious. We may glance at the following data of temperature:

	Jan.	April	July	Oct.	Year	Average	
						Max.	Min.
Gibraltar	54	61	74	65	63.5	93	38
Malaga	54	61	79	66	64.6	105	36

Frost is rare at Gibraltar and Malaga, but temperatures as low as 20 degrees may occur on the east coast. The hot winds of summer are as trying as in California, including also the dust and a very low humidity; the absolute maxima range from 110 to 114 degrees. At Gibraltar the influence of the Atlantic Ocean begins to be felt; the summer heat is mitigated by sea breezes, and the maxima rarely approach 100.

Valencia has 260 clear days in the year; the proportion of cloudiness falls below 15 per cent. in midsummer. The summer is almost rainless everywhere, and most of the east coast suffers from drought at all seasons.

Malaga is at its best from November until May, it is far too warm from June until October; accommodations there are fairly good, and the place is gaining a very favorable reputation as a resort for the winter and early spring.

The interior of Spain has an extreme continental climate, resembling that of our Rocky Mountain plateau. We may glance at the following table:

	Elev.	Jan.	April	July	Oct.	Year	Average	
							Max.	Min.
Madrid	2,150	40	54	75	55	55.0	103	17
Valladolid	2,500	37	52	70	52	53.0	101	13

The absolute extremes for ten years at Valladolid were 110 and −6.

Madrid has only 16 inches of precipitation annually, of which only two fall in summer, and the remainder are pretty evenly distributed through the year, with a slight maximum in May; Valladolid is almost desert-like, with 12 inches annually. In Madrid the humidity in July falls to 44 per cent. and the cloudiness to 19; the winter is fairly damp and cloudy, as is usual in similar situations in this latitude. There is plenty of frost in winter, but the amount of snow is moderate; the total sunshine for the year is 2,930 hours (70 per cent.), about the same as at Salt Lake City, which has almost exactly the same climate in other respects, save for a decidedly colder winter.

Mediterranean France resembles eastern Spain, but the winter is slightly colder; the Riviera is different and quite anomalous. In winter the icy mistral blows on two days out of three, bringing zero weather almost to the coast. Temperatures follow:

	Jan.	April	July	Oct.	Year	Average	
						Max.	Min.
Montpellier	42	55	74	58	57.4	99	15
Marseilles (C)	44	55	72	60	57.8	—	—

The mistral is most violent at Avignon, where it is powerful enough to upset railway trains, and all the trees are bent over southwards.[1] The precipitation is exceedingly small at all seasons, 20 inches per annum at Marseilles, of which 3 fall in summer and 7 in autumn Snow is not very common, for the sky is almost always clear when the mistral blows; the temperature on these occasions has fallen to zero as far south as Avignon.

This climate is little better as to temperature than our Middle Atlantic Coast, and worse as regards high cold winds, which is saying a very great deal. Our own northwesters rarely exceed sixty miles per hour, a rate undoubtedly surpassed in southeastern France, where these gales are also more frequent. The region cannot be recommended to any save the very robust, and the contrast to the Riviera, lying immediately to the eastward, is far greater than shown by the average thermometric figures.

The Riviera. The remarkable strip of coast known as the Riviera is usually regarded as extending from Hyères to Leghorn, Genoa being the dividing point between its western and eastern portions. This region owes its phenomenally mild winter, in the latitude of northern New York, to the wind shelter afforded by the Maritime Alps and the Apennines; these mountains, however, rise immediately from the shore only from Nice to Spezia, the outer ends of the Riviera being less sheltered; we have therefore presented to us the anomaly of colder winters in the more southerly portions, and the greatest mildness at the center of the arch, lying farthest northward. At the western end the mistral still blows with

[1] Hann, vol. III., p. 47.

some frequency and violence; Leghorn, also, is somewhat exposed to cold north winds; the intermediate parts are sheltered, and when the north winds are felt at all, they are dynamically warmed by their descent to the sea.

Unfortunately but few accurate temperature data are available; those extant are here given:

	Jan.	April	July	Oct.	Year	Average Max.	Average Min.
Nice (C)	47	58	75	63	60.3	88	30
Genoa (C)	45	57	75	62	59.4	—	—
Leghorn (C)	44	56	75	61	58.5	—	—

Temperatures below 25 degrees are exceedingly rare, but it is evident that the winter is not nearly so mild as in southern Spain or southwestern California. Snow falls once or twice in each winter, but prolonged spells of bad weather are uncommon; we must not fail to note, however, that the rainfall gradually increases as we advance eastward into Liguria and Tuscany; the percentage of cloudiness also rises, though the majority of the winter days are still pleasant. Even aside from the superiority of the accommodations, the western Riviera is therefore preferable to the eastern portion.

In spite of its warmth, the summer on the Riviera is rather free from malaria, in marked contrast to places farther south having the same temperature; this difference is unquestionably due to the absence of marshes, and is an advantageous feature for such persons as require a mild climate in the late spring or early autumn; October is quite a safe and pleasant month on the Riviera, whereas it is rather dangerous even a short distance farther south or inland.

The Po Valley. Most startling is the change in winter, on crossing the Apennines from Genoa to Turin; Alessandria, only 300 feet above sea level, and forty miles from Genoa, is 14 degrees colder in January on the average, but during cold spells as much as 25 degrees, for the temperature may fall below zero. In a modified degree, this relative coldness extends eastward to the Adriatic, but diminishes northward, toward the Alps, where the lake resorts have a much milder winter, with minima not nearly so low as on the plain. The summer does not differ materially from that of the Riviera, being in fact rather hot for the latitude. Temperature tables follow:

	Jan.	April	July	Oct.	Year	Average	
						Max.	Min.
Milan (C)	32	54	75	55	53.8	94	12
Venice (C)	36	54	75	58	55.0	—	—

Only the spring may be safely recommended in this section; the winter is rather cold and somewhat changeable, with a good deal of cloudiness; the summer and early autumn are very malarious, and the late fall is unpleasantly wet. Of about 32 inches of rain 10 fall in autumn and 8 in spring, a trifle less in summer and over 6 in winter; the distribution is therefore not very uneven. October is the wettest month. Heavy snow is common from December to February, and may lie on the ground for weeks at a time.

The Italian Peninsula. Here we encounter a gradual increase of warmth as we go south, but the temperature of the Riviera is not reached until we come to the 41st parallel, north of which the vegetation of the warm temperate zone is but feebly developed. In the mountainous interior the climate, of course, is colder, and the

country is more or less liable to be snowed up in winter as far as Calabria. There is no great difference, in winter, between the western and eastern shores of the peninsula, but in summer the Adriatic Coast is considerably warmer, though perhaps not so unhealthy, marshes being less frequent and extensive. The temperature is as follows:

	Jan.	April	July	Oct.	Year	Average	
						Max.	Min.
Florence (C)	41	57	76	59	58.3	—	—
Rome (C)	44	57	75	62	59.5	95	26
Naples (C)	47	57	76	63	60.6	—	—

This section, also, is at its best during the spring; the winter is not very mild north of Naples, and the summer and autumn, outside of the great cities, are rendered very dangerous by malaria.

Of 33 inches of rain, 11 fall in autumn, 9 in winter, 8 in spring, and only 5 in summer. At the last season the humidity falls to 58 per cent., with hot days and nights that are fairly comfortable if the ubiquitous mosquito be excluded. The proportion of clouds at Rome ranges from 50 per cent. in winter to 25 in summer, so that Italy has a sky no clearer than that of much of the United States. The amount of sunshine ranges from 2,200 hours in Piedmont to 2,600 and more in the south.

The Mediterranean Islands. Of the islands in the western Mediterranean Sea we need consider only Corsica, Sicily and Malta; Sardinia and the other islands are in too backward a state to offer good accommodations to health seekers.

The following table gives an idea of the temperature:

	Jan.	April	July	Oct.	Year	Average Max.	Average Min.
Ajaccio (Corsica)	49	57	77	66	62.6	—	—
Palermo (Sicily)	51	59	77	67	63.5	103	35
Malta	54	59	77	69	64.0	96	42

The winter becomes wonderfully mild as we go south, but even Corsica is perhaps the warmest place in the world for the latitude; frost and snow are uncommon everywhere, except in the mountains, and are practically unknown in Malta; we may note that Corsica is as far north as Massachusetts, and Sicily in a line with Virginia. The best season extends from November until April; even May is cooler than October, when the weather is still quite hot and malignant forms of malaria are rife. In Sicily and Malta there is only about half an inch of rain for the entire summer, whereas 16 inches fall between October and January, and 5 more in February and March. The humidity rarely falls as low as on the Italian peninsula, 60 per cent, in July being the lowest in Palermo and Syracuse. At such places, however, as Palermo, it falls to desert-like figures when a sirocco runs the temperature up to 105 to 115 degrees in the shade.

Istria and Dalmatia. The Adriatic coast of Austria-Hungary somewhat resembles the Riviera, but it lies farther north, is decidedly colder in winter, and nowhere free from the terrific northeast wind (bora) that resembles the mistral of southern France. The east shore of the Adriatic is, however, very much warmer in winter than the Italian side, for the bora, though keen and cold, is still warmed considerably in descending from the Alps; in addition warm and moist winds from the Adriatic are

frequent, raising the temperature in the cold season and tempering the heat in summer.

The following table gives some thermometric data:

	Jan.	April	July	Oct.	Year	Average	
						Max.	Min.
Treste	39	54	74	59	55.9	91	21
Fiume (Abbazia)	41	54	73	58	56.1	91	24
Ragusa	48	58	77	65	61.9	91	31

The lowest temperatures for fifteen years were 14 degrees at Trieste, 16 at Fiume, and 21 at Ragusa. At Fiume there are 60 inches of precipitation, of which half falls from September to January, and the other half is well distributed over the other seven months. At Ragusa there are 65 inches of rain, of which 27 fall from October to December and only 8 in summer. Snow is fairly common northward, falling in blizzard-like storms, but becomes infrequent toward the south. In summer and autumn the moist sirocco is very oppressive, resembling the warm and damp sea-breezes of our South Atlantic Coast. It may be said, briefly, that the suitableness of this region for invalids is similar to that of the Italian peninsula, but the bora must be avoided as far as possible by a careful choice of location, *e.g.*, at Abbazia, and the summer is malarious at many places.

Greece. In Greece only Corfu and Athens have any interest for us, the remainder being excluded by the semibarbarous conditions still prevailing in most places. This country, in the lowlands, has a mild but somewhat changeable winter and spring and intense heat and drought after the first of June. Corfu has about 50 inches of rain, but only about 4 of them fall in summer, and the small allowance of 15 inches at Athens is con-

centrated on the period from October to March (12 inches); the proportion of clouds at Athens is similar to that of interior California; indeed, these two regions resemble each other greatly in almost every climatic detail. The temperatures for Greece are as follows:

	Jan.	April	July	Oct.	Year	Average Max.	Average Min.
Corfu	49	59	78	67	63.0	95	34
Athens	47	59	81	66	63.1	101	29

Snow is very rare at Corfu, but falls nearly every winter at Athens.

Algeria. Algeria offers a number of good resorts, but Americans have hardly begun to familiarize themselves with this region, which presents every climate of our Southwest, except the cool and foggy summer of the immediate Pacific Coast. The following data indicate the temperature:

	Jan.	April	July	Oct.	Year	Average Max.	Average Min.
Algiers	53	60	76	66	63.3	99	38
Biskra	51	67	89	68	68.5	113	32

Biskra lies at the edge of the Sahara desert, and has a climate very much like that of Phœnix, Arizona; the 8 inches of rain fall chiefly in spring and fall, but there are some summer showers; otherwise inland Algeria has a rainy season from October to March (80%) and a dry one from April to September (20%); in the city of Algiers 12 inches fall in winter, and only one in summer.

Algiers is pre-eminently a winter resort on the coast and in the desert, and a spring resort in the mountains, where deep snows are not rare from December to March,

and the temperature often falls far below the freezing point.

Egypt, except in the lower Delta, has a dry climate, which becomes absolutely desert-like as we go southward. I shall begin by giving a few thermometric data:

	Jan.	April	July	Oct.	Year	Average	
						Max.	Min.
Alexandria	58	66	79	75	69.1	99	45
Cairo	53	70	84	73	70.3	109	36
Assuan	59	78	92	79	77.0	115	40

At Alexandria the summer heat is mitigated by steady north winds from the Mediterranean; in autumn these often fail, and October is therefore about as warm as June; the hottest weather of the year usually occurs in September or October. The humidity is 66 per cent. in January, and 76 in July; no rain falls from March to September, ten inches during the remainder of the year.

At Cairo it only rains an inch or two (in winter), and farther south rain is a curiosity; the humidity is still not so very low at Cairo, 61 per cent. for the year, and 45 in May, but in the deserts of upper Egypt the proportion of moisture is only about half as much, and the same as in our own southwestern deserts. Cairo has 30 per cent. of clouds in January and only 8 in June.

Upper Egypt is tolerable only in winter, Cairo from November to March; accommodations are becoming first-rate. In every case an intermediate station should tide over the season of early spring, before returning home.

Syria and Palestine. It is easy to foresee that these regions will soon be drawn upon as health resorts, for accommodations are improving rapidly, and a number

of stations are becoming quite accessible. I give temperatures from Beirut and Jerusalem:

	Jan.	April	July	Oct.	Year	Average Max.	Average Min.
Beirut	55	65	81	75	68.7	95	39
Jerusalem (2,500 feet)	47	60	76	69	62.8	102	32

Beirut is too hot but very dry from April until November, Jerusalem from May to October: at the latter place the absolute range of temperature is from 112 to 25 degrees, there are 17 inches of rain in the cool months, and not a drop falls from the middle of May to the middle of October. There is some snow in most winters, but it rarely remains long on the ground.

A CLASSIFIED LIST OF FOREIGN RESORTS

CLASSIFICATION BY CLIMATE

A. *Warm and moderately moist.* Madeira, the Azores, the Mediterranean islands, the Algerian coast, the south coast of Spain, southern Portugal, the coasts of Egypt and Syria.

B. *Warm and dry.* The Algerian Sahara, lower Egypt away from the the coast.

C. *Warm and desert-like.* Upper Egypt.

D. *Very temperate and moderately moist.* The coast of northern Portugal.

E. *Warm temperate and moderately moist.* The Riviera, southern Italy, Dalmatia, Greece, inland Algeria, the coast of Asia Minor.

F. *Warm temperate and dry.* The Spanish plateau (lower levels), interior Palestine.

G. *Middle temperate and moderately moist.* The south-

east of France (except the Riviera), central and northern Italy, Istria and southern Tyrol.

H. Middle temperate and dry. The Spanish plateau (higher levels).

I. Cool temperate and moderately moist. The remainder of central and southern France (excepr the mountainous regions), the cooler resorts south of the Alps, the middle course of the Danube, beginning near Vienna.

J. Cool and very moist. The coasts from northern Spain to the North Cape.

K. Cool and moderately moist. Inland western and central Europe. (More than half of Europe, outside of Russia, belongs to groups *J* and *K*).

CLASSIFICATION BY COUNTRIES

A. Western Europe

England. On the south coast, from west to east: Penzance, Salcombe, Torquay, Teignmouth, Exmouth, Sidmouth, Bournemouth, Ventnor, Brighton, Hastings, Folkestone, Dover; also the Channel Islands.

Netherlands. Scheveningen, Flushing (Vliessingen).

Belgium. Heyst, Ostende, Blankenberghe.

France. Dunkirk, Calais, Boulogne, Treport, Dieppe, Fécamp, Trouville, Cherbourg and St. Malo on the English Channel (except the first two on the North Sea); Brest, Les Sables d'Olonne, Arcachon and Biarritz on the Bay of Biscay; Vichy near the center; Plombières in the Vosges Mountains; Pau, Tarbes, Eaux-Bonnes, Luchon and Barèges (4,000 feet) in the Pyrenees, the last three with warm sulphur baths; Aix-les-Bains (sulphur springs), Annecy and Evian-les-Bains on

subalpine lakes; Chamonix (3,400 feet) in the high Alps.

Spain. San Sebastian on the Bay of Biscay.

B. Central Europe

Germany. Norderney, Helgoland and Sylt, islands in the North Sea; Rügen, Usedom and Wollin, islands off the Baltic Coast; Harzburg and Blankenberg in the Harz Mountains; Görbersdorf (for tuberculous subjects) in Silesia; Aix-la-Chapelle (Aachen), with sulphur baths, in the northwest; Ems, Wiesbaden, Homburg, Wildungen, Nauheim[1] and Kreuznach[1] in the hill section from Mayence to Cassel; Oeynhausen[1] near Hanover; Baden-Baden, St. Blasien, etc., in the Black Forest; Kissingen in northern Bavaria; Reichenhall[1] and Berchtesgaden in the Bavarian Alps.

Austria. Carlsbad, Marienbad, Franzensbad and Teplitz in Bohemia; Innsbruck, Salzburg, Ischl, Hall[1] and the Dolomite Region on the north slope of the Alps; Meran on the southern slope; Riva on Lake Garda.

Switzerland. Montreux and Ouchy on the Lake of Geneva; Lucerne, Brienz and Interlaken on the central lakes; Grindelwald, Mürren, Davos, St. Moritz, Pontresina, Zermatt, and a host of others at elevations from 3,500 to 5,500 feet; Lugano and Bellinzona on the southern slope of the Alps.

Italy (Lake Region). Pallanza, Stresa, Menaggio and Bellagio on Lakes Maggiore and Como.

C. Southern Europe

Spain. Malaga.

The Riviera. Hyères, Cannes, Nice and Mentone in

[1] Brine baths; see page 360.

France; San Remo, Bordighera, Nervi, Spezia and Leghorn in Italy.

Italy (*Peninsula*). Pisa, Florence, Rome; Ischia, Capri, Sorrento and Castellammare near Naples; Palermo, Catania and Taormina in Sicily.

Austria-Hungary. Abbazia, Pola, Lesina and Ragusa on the Adriatic.

SEA VOYAGES

Our foregoing review of climates and health resorts, though it has included some oceanic islands, still requires a few remarks concerning conditions on the high seas, and their utilization, if we wish our account to be complete; this leads to the discussion of treatment by means of ocean voyages, freely recommended some years ago to chronic invalids, including children, notwithstanding that the attendant discomforts were even greater then than now. Recent times have witnessed a great diminution of some of the disagreeable features of ocean travel, yet the enthusiasm for this method of climatotherapy has fallen off considerably. Much of this abatement of interest is due to a better knowledge of our resources on shore, but more is attributable to a recognition of the inherent defects of the sea-voyage treatment, which are so serious as often to more than neutralize its undoubtedly good features.

In detailing the merits of this method we cannot do better than to follow Weber,[1] taking them up seriatim, and noting the corresponding objections one by one, as we go on.

The first benefit derived, and the most obvious, is the

[1] British Medical Journal, June 3, 1899.

opportunity to breathe a really pure and germ-free air, to be found elsewhere only on the highest mountain tops and in the arctic wilderness; to this purity there is added a trace of salinity, which has also been considered of some therapeutic value, possibly without any real reason. Against this positively good point we must set the usually decidedly foul atmosphere of the saloon and cabins, particularly aboard small ships and in stormy weather, when the hatches are closed. As life on deck, the main object of the voyage, is almost impossible when the sea is rough, the passenger may be compelled to spend whole days under not very wholesome conditions.

Secondly, Weber refers to the even temperature at sea; this does not, however, obtain universally by any means, for the northwestern portions of the Atlantic Ocean, for example, are known to experience rather wide fluctuations during the colder months. Relatively speaking, however, Weber's statement may be accepted; on the tropical and subtropical seas the temperature is indeed exceedingly uniform, and rather high, ranging almost all the time between 70 and 80 degrees. Such even warmth is, of course, very enervating, as Weber himself admits; in the belt of trade winds there is some compensation in the way of almost uninterrupted fine weather with fresh breezes, but in the so-called horse latitudes north of this belt, as well as in the equatorial zone of calms, the heat sometimes becomes quite distressing, and is acknowledged to be harmful.

Thirdly, there is the stimulating effect of abundant sunlight and strong winds. North of the 45th parallel, it must be said, the excess of sunshine is not much in evidence, and the mantle of clouds may be unbroken

for weeks at a time in autumn and winter; in warmer latitudes, save in the cloudy equatorial belt, the sun does shine for about three-fifths of the time. As to the breezes, we can understand that they are very desirable when moderate; but since, in most regions, they develop into gales at frequent intervals, they are apt to involve considerable discomfort to the health-seeking landsman. Violent winds are an objection to many coast stations; it is easy to comprehend their still more trying roughness on shipboard.

Fourthly, we may turn to consider the mental rest that comes with a sea voyage. This does exist on the longer and less traveled routes, and really forms the most incontestable advantage of such a trip; it is, unfortunately, almost altogether absent on such short and tourist-frequented lines as those to Europe and the West Indies; indeed, for the reason stated, these short voyages have been omitted from the list of our therapeutic resources; life on a great liner has become exactly like that in a fashionable hotel, without the means of avoiding tiresome neighbors by taking a walk or drive, as is possible on shore, when the sense of ennui becomes oppressive. These objections apply almost equally to those longer tours, now extremely popular, to the Mediterranean and the Spanish Main, on which an almost continuous round of amusements and sight-seeing consumes the time and energies of the traveler; such voyages, also, can rarely be recommended to invalids, with any confidence.

We have gone over the real advantages of ocean voyages, and noted the corresponding drawbacks, but there are other deficiencies that are without any sort of

compensation. Most important of all, those long routes, which alone give the desired rest, are without the services of a really first-class medical attendant; it is still customary, on many lines, to engage a very young surgeon for a single voyage; he is apt to be a practitioner with few qualifications for the management of a chronic, especially a neurotic invalid. Secondly, these same lines, as well as some very popular ones, furnish their passengers with food that is often coarse and lacking variety, readily disposed of, perhaps, by the conventional type of robust Briton, but quite unassimilable by a person whose digestive powers have become impaired. The situation of a delicate child, not quite accustomed to the motion of the ship, confronted with such comestibles as boiled corned beef and roast pork, instead of its proper food, is not fraught with great promise of rapid restoration to health. Thirdly, of course, comes seasickness, which I mention last because it is usually overcome in a few days; some persons, however, never acquire a good pair of sea legs, and the first patient that we send on a sea voyage, for his health, may be one of those unfortunates. The result to him and his physician is likely to be not at all questionable.

We have jotted down sufficient data to establish the doubtful value of sea voyages in the treatment of disease; we may add that all the adverse circumstances are aggravated in the case of children, and some of the good ones impaired. The subject has been presented for the sake of completeness, and because of its former vogue in certain medical circles of high repute; it has evidently entered on a stage of declining popularity, and shall receive little attention in the later chapters of this

treatise. The benefit of an ocean voyage may be obtained quite as readily, with no risk and less discomfort, at the ocean's edge.

SEA BATHING

While it is apart from the purposes of this manual to discuss hydriatric or balneological treatment, the special variety of sea bathing is so closely interwoven with certain aspects of climatotherapy, that a few remarks on this subject are not easily avoidable. In sea baths we possess a particularly powerful stimulant; they form one of the more strenuous hydrotherapeutic procedures under some conditions; under others, again, they may be regarded as a rather mild measure. This difference is mainly due to variations in the sea temperature, partly to the quality of the surf and the coincident temperature of the air. It is clear that we must observe certain precautions in administering sea baths to children, even more than in the case of adults, so that the following notes will not be superfluous.

Strong surf, with violent breakers, is to be avoided totally, for, aside from the actual danger which exists at many places and has led to fatalities, the element of fear on the part of the child cannot safely be disregarded, and the physical shock of the pounding seas is almost always felt very unpleasantly, and leaves a good deal of prostration in its train, save in an unusually robust subject. At places where the conditions are such as just mentioned, the period of low tide should be selected as the bathing time, for the breakers are then relatively small and feeble. This necessitates an almost daily shifting of the hour for the bath, often to inconvenient

portions of the day, so that one is often tempted to omit treatment for a week at a time. In stormy weather, an intermission, until the sea quiets down, is also invariably necessary.

For fairly robust children, the temperature of the water should not be lower than 60 to 65 degrees, for the more delicate ones 70 is the limit. Unfortunately, reliable data as to the ocean temperature at the various resorts are fragmentary; I shall have to furnish many facts from personal observation. On our Atlantic coast, Massachusetts is near the northern limit for children, at least of tender years, the season lasting from early July to the end of August; in New Jersey, the water is often sufficiently warm in the latter half of June, and baths may be continued well on into September. The season progressively lengthens as we go south, until, in southern Florida, the water is none too cold in midwinter. On the Pacific coast the water is rather cool everywhere, the difference between the summer and winter being insignificant, whereas it amounts to over thirty degrees off New Jersey. Santa Barbara represents about the northern limit in California for all but the very robust, and even here the average temperature of the water is only 65 degrees in summer, though it averages 60 in winter; at San Diego fairly hardy children can indulge in ocean baths the year round, by selecting favorable days. Turning to Europe, we find that the Mediterranean is sufficiently warm only from May to November, for its winter temperature (55 to 60 degrees) is rather low for young invalids, though some seaside sanatoria administer sea baths throughout the year, even in frosty weather. In midsummer the temperature of the Mediterranean

Sea is quite uniformly 78 degrees, similar to that of our South Atlantic coast, and warm enough to permit quite a prolonged stay in the water. On the west coast of Europe conditions resemble those on our Pacific coast; north of the Bay of Biscay temperatures above 65 degrees are rare, and only very short dips are permissible. On the German coasts we note a decided difference between the North Sea and the land-locked Baltic. The former has strong tides and a fairly rough surf, and is, in fact, almost altogether unsuitable for our purposes; the latter is somewhat warmer in summer, and very much quieter, and the Germans give it a very decided preference. The Channel resembles the North Sea, save that it is warmer and less rough, but the tides are very strong. The temperature here is just warm enough for a very brief plunge, as it rarely rises much above 60 degrees under the most favorable conditions.

It will be seen that the above outline is somewhat sketchy. The trouble lies chiefly with the advocates of strenuous hardening, who cannot find the water cold enough; conservative investigators in this field have remained conspicuous by their absence.

As to the duration of sea baths, I can lay down a fairly good plan from my own observations. Robust children may stay in only for a minute or two, when the water is at 60 degrees; at 65 three to five minutes may be allowed, at 70 ten minutes or a little more; on those occasions, exceptional on our Middle Atlantic coast, when 75 degrees are reached, even fifteen to twenty minutes may do no harm if the air is warm, and the weather sunny. For more delicate and younger children these allowances must, of course, be reduced, and the 60-degree baths cut

out altogether. The common American custom of prolonging sea baths until cyanosis is fully developed is highly reprehensible and harmful; the reaction test applies to sea baths as well as to those taken in a tub, and its development is the signal for leaving the water. If the reaction fails to set in at all, the bath has been too cold, and is not suited to the individual in question.

To obtain the full benefit of a sea bath, it is almost essential that the air should be warmer than the water; a slightly lower temperature of the atmosphere may, however, be compensated by bright sunshine and the absence of strong winds. The best time for bathing is about an hour before the noonday meal; when this is prevented by tidal conditions, a shorter dip before breakfast, or a bath in the middle of the afternoon may be substituted; preferably the former, unless the weather is very cool or the sun obscured.

GENERAL REMARKS

Erb[1] has very wisely said that we may send our patient to a good climate, but cannot control the weather after he arrives there. When he visited the Engadine in December he found no snow to speak of; the natives assured him that this was phenomenal. When I visited Rome in January 1894, I found a veritable New England snowstorm raging; the remarks of the natives corresponded precisely to those recorded by Erb. Atlantic City, the present eastern climatic panacea, had a Massachusetts winter in 1904–5, and a Virginian one in 1905–6. Los Angeles, the western Mecca of health seekers, is deluged with rain in one winter, and desert-like in

[1] Sammlung klinischer Vorträge, 1900, No. 271.

another; in St. Augustine there is a frequent alternation in the prevailing equipment between furs and fans. Similar variations obtain at nearly all other health resorts.

It is evident that the best laid plans of climatotherapy may end in disappointment. The gauging of climate has reached mathematical accuracy, the prediction of the weather rarely succeeds beyond forty-eight hours. All that we can promise our patient is the probability of certain conditions, but we cannot assure him that he will find more than an approximation to the object of his search. It is a doubtful procedure, therefore, to send an invalid to a climate that does not differ from that of his home quite fundamentally; unless careful climatic study precedes such advice, it were better not to give it at all, save where the mere change of scene is a desideratum.

More failures, however, result from mistaken notions about the climate of regions unfamiliar to the counseling physician. The delusion as to the remarkable mildness of Lakewood and Atlantic City, so fondly cherished by New York physicians, and encouraged by financially interested parties, is paralleled everywhere. I have referred to the "dry" cold of the Adirondacks, and the "dry" heat of Arizona, of which only the latter is a fact, but not any too comfortable on that account. It is well to remember that winter remains winter, save in the tropics, and that summer brings some hot days everywhere, except in positively arctic climates. The patient should therefore be advised to provide clothing adapted to the season, not to certain reported conditions that may be exceptional. The physician, for his part, should

study climate from the ample data now at hand, referring to statistics when necessary; treatment according to time-honored traditions or random information is to-day as inexcusable an error in climatotherapy as in every other branch of therapeutics.

CHAPTER IV

THE CLIMATIC MANAGEMENT OF THE NORMAL CHILD

During intrauterine life no production of heat is required on the part of the foetus; the apparatus designed for that purpose is set in action only after birth, and functionates very imperfectly at the beginning, so that the infant's temperature sinks to 95 degrees and below during the first few hours. Throughout the earliest weeks of infancy the abstraction of body warmth is borne very badly, any reduction by radiation into the relatively cool surrounding medium, especially if accelerated by air currents, is compensated with difficulty, and a subnormal temperature, with its attendant risk of disease, is readily established. The indifferent temperature declines only very gradually from 99 degrees at birth to the figure normal at a later age, and exposure of any sort must be balanced quite accurately with suitable clothing. Great and sudden changes of temperature are extremely dangerous during this period, for it is impracticable always to combat them promptly with the application of additional external warmth and covering. It is therefore advisable, save during very warm weather, to keep the infant indoors during the first month, regardless of the season.

After four or five weeks the question of the baby's first outing comes up, and must be decided according to circumstances, sunshine and warmth being the prime

requisites. The time should be about noon, on a bright day, with little wind, and a temperature not below 65 or 70 degrees. It is evident that in winter, or in a cold, gloomy, or windy climate, the first airing is likely to be postponed for weeks and even months; the parents as well as the medical attendant are then apt to become impatient. It is undeniable, however, that any material deviation from this rule, arbitrary as it seems, is a hazardous experiment; too often the infant's first illness is directly traceable to an ill-advised attempt of this kind, and it is better to err on the side of excessive caution. It is, of course, understood that a certain relaxation of the above requirements is permissible in an infant that has attained the age of two, three or four months; the temperature in particular need not be nearly so high as just stated.

Throughout infancy, the child should be kept at home in the early morning, and brought back within one or two hours of sunset; the advantage of breathing the purer air out of doors is more than neutralized by the dangers involved in exposure to the chilly dampness that prevails shortly after sunrise, and the increasing humidity and rapid fall of temperature in the late afternoon. In places subject to the sea breeze special precautions must be taken during the latter portion of the day, the spring months calling for particular care in this regard, whereas the late summer and autumn are less dangerous; at the last-named season the early hour of sunset gives ample warning to the infant's attendant, and the temperature changes toward evening are less abrupt.

After the second year the child may gradually be

inured to the climatic conditions that it will have to encounter during its school life. This is the age favored by the advocates of what is known as hardening, the training process through which the child is expected to revolutionize, both rapidly and thoroughly, the relations of its complicated and delicate organism to all kinds of atmospheric changes. We shall presently have abundant opportunity to give separate and detailed consideration to the subject of hardening; at this point it will suffice to state that any habituation to new and untried conditions must be effected gradually, step by step, as it were; slow and sure methods are absolutely essential to secure a normal power of resistance to adverse climatic influences. It is, quite naturally, true that absolutely perfect results or even uninterrupted progress represents an ideal that we can hardly hope to attain; unlucky experiments and untoward happenings are almost unavoidable; still, in view of the very remarkable eccentricities of most of the climates miscalled temperate, the net results of a system of training, followed consistently in the suggested fashion, average fairly good. This is the more creditable when we consider that, in a highly civilized community, the individual is endowed by heredity with a somewhat pampered constitution.

The method of training just sketched, sound in theory and tolerably good in its results, is rarely carried out consistently and intelligently. Whereas the rearing of plants and the lower animals is largely in the hands or under the guidance of trained experts, that of the child is regularly intrusted to unskilled mothers or, still worse, ignorant nursemaids. The life history of the

average city child consists, for the most part, of a succession of respiratory affections during the cooler months, and digestive troubles in summer, this seasonal distribution obtaining, of course, only in a general way. The final consequence is likely to be a more or less delicate constitution by the time the school age is reached. It is quite safe to say that the majority of such children as are below par, without demonstrating any definite organic disease, owe their relative feebleness to the cause stated; in our climate, at any rate, there can be no doubt that frequently recurring and alternating digestive and respiratory diseases play the leading rôle, exceeding even that of the infectious diseases, in stocking our communities with a race of young weaklings.

I fancy that very few of us will dispute the general proposition that the theory of climatic training has not progressed beyond the merest outline; yet this confessedly rudimentary plan is rarely subjected to that thorough and consistent trial, which alone can aid us in filling in the present rude framework. As matters stand now, the children growing up among us have an undeniable and lamentable tendency to be physically subnormal; they are evidently imperfectly fitted to withstand the ordinary vicissitudes of their environment, among which meteorological changes form perhaps the greatest part.

The statistics of infant and juvenile mortality would appear to show that an era of progress has set in, and that the situation is improving; the fallacies in this argument are only too easily demonstrated. Formerly, only the fittest survived, the others succumbed; modern medical science saves many of the latter from death, to

drag out a more or less impaired and wretched existence; thus, many competent observers claim to note a steadily increasing ratio of subnormal children in both the urban and rural populations.

It is evident, from the above discussion, that the prime indication is prophylactic; the climatic management of the normal child thus fills a large and not unfruitful field of medical endeavor. At the commencement of this chapter the opportunities for climatic training, in the ordinary sense, were shown to be greatly restricted during infancy and early childhood; we are therefore thrown back on those artificial aids, which may be called the climatic auxiliaries, namely, clothing, heating and ventilation. Of these, the subject of clothing demands discussion here only from certain points of view; it involves at least as many social as hygienic considerations, and is known to have originated primarily through motives of the former class, to which the regard for mere health has always been subordinated. The employment of clothing, furthermore, may be reduced to a minimum by an adequate supply of artificial heat; we may, therefore, for the present, pass by that subject to take up the more important themes of warming and ventilation, touching on the merits and demerits of the various methods whereby they are obtained and regulated.

Artificial Heating and Ventilation. For a young infant the proper room temperature is from 72 to 74 degrees; as the child grows older, this may advantageously be reduced to about 68. The heat of the American summer renders the maintenance of the proper room temperature

impracticable, save during the cooler periods; when a hot wave prevails it is apt, especially in stone houses, to remain persistently above 80 degrees for a week at a time. It is a curious but inevitable result of our highly artificial life that our apartments enjoy a more even temperature in winter than in summer; it follows that the infant is exposed to greater thermal vicissitudes in its home during the latter season. Now, there is some natural hesitation about stripping off the greater portion of an infant's clothing during a warm spell, and there is apt to be remissness in adding to its wraps when the weather cools off. The result is that the infant is very often either over- or underdressed in the summer season, and it is, of course, exposed to risks in either event. We find in this circumstance an explanation of the frequency and persistency of the "summer cold," which may attack children who rarely suffer from disease of the respiratory organs in winter.

We have noted that, to the nude body of the healthy adult, the indifferent temperature of the air is about 80 degrees; it is undoubtedly higher in the case of infants and young children, but the exact figure is indeterminable. Experience shows, at any rate, that a temperature above 85 degrees, unless the humidity is very low, is distressing to an infant as ordinarily clothed; the baby becomes bathed in perspiration, which rapidly sets up an acute dermatitis, its sleep becomes light and fitful, its digestive apparatus becomes readily deranged, and its respiratory organs grow exceedingly sensitive to very slight thermal changes, the last two forming important parts of the physical condition called enervation.

It is impossible to lay down a hard and fast rule as to

the proper season for inaugurating the supply of artificial heat. So much depends on the construction and situation of the individual dwelling, that the room thermometer is practically the only trustworthy guide. Country houses, even in the latitude of New York City, may occasionally require an open fire during an exceptionally cool spell in summer; in cities, where the houses adjoin one another, we may safely await the first hard frosts of October or early November, and discontinue heating when settled spring weather arrives in the course of April.

It will, perhaps, not be out of order to devote some space to the merits and deficiencies of the various modes of heating in vogue, five systems being in more or less extensive use in this country.

The iron coal-stove may be mentioned only to be condemned. Its use involves a very unequal diffusion of warmth through the apartment, and there is almost always some contamination of the air with carbon monoxid; this reaches a dangerous amount whenever there is a tendency to back draught, as may occur with certain winds or structural defects in the chimney, or be due to simple mismanagement of the stove itself. The porcelain stove, heated with briquettes of coal waste, which is in extensive use in western Europe, is almost ludicrous in its inefficiency, even in the rather mild winters of Paris; in our northern states it would be all but worthless, and little effort has been made to popularize this very inadequate heating apparatus on our side of the Atlantic.

The open fireplace, burning either wood, coal, or gas,

has much to recommend it, since it forms a perfect ventilating plant as well, when in operation; its chief defect is that most of the heat escapes up the flue, and the room itself is barely warmed at all; almost all the benefit we get from an open fire is by direct radiation. For this reason alone, this method is suitable only for mild climates and the moderately cold spells of spring and autumn; during our northern winter it has merely auxiliary value, and may even be omitted altogether where other more efficient heating plants are provided.

Most of our private dwellings are warmed with the hot-air furnace, which is easily worked and maintains an even temperature, though it will invariably be found that the upper floors receive much more warmth than the lower stories. This system combines with its undeniable good qualities two serious defects. In the first place, it is entirely too well adapted to supplying our home atmosphere with baked street dust of various kinds, mostly unpleasant to contemplate. This dust, furthermore, is far from sterile when it enters our rooms, for dry heat, of the moderate intensity applied in the furnace, is a most unreliable disinfectant. We may, however, mitigate this evil very largely by filtration through cotton, which must naturally be changed at intervals. The second, almost equally grave, and hardly remediable defect of this method is its effect on the relative humidity in our rooms. Saturated air at zero contains 0.03 ounce of aqueous vapor to the cubic yard, at 70 degrees it contains about 0.6 ounce; it follows that, in zero weather, the street air, taken into our houses and suitably warmed, has a saturation deficit of over half an ounce to the cubic yard, and a relative humidity of only

five per cent. This does not, of course, actually occur to this degree, for such intensely dry air absorbs moisture from everything it touches, including the furniture of the rooms, and the human bodies inhabiting them. Under the best arrangement extant, however, the requirement to raise the proportion of moisture to 50 per cent., namely, the provision of about six gallons of water to half saturate the atmosphere of an ordinary dwelling,[1] with frequent renewal of this supply, is not fulfilled. It is true that a ridiculously small receptacle for water is attached to the furnace and supposed to be filled regularly; some persons fasten tiny basins, holding about a pint, to the registers in their rooms; I doubt if the amount of water thus supplied amounts to a gallon a day under the customary management. It is therefore not at all remarkable, that all who have investigated the relative humidity in our dwellings, report a desert-like dryness; Freudenthal,[2] for example, observed 15 per cent. in zero weather, and 30 per cent. on moderately cold days in his own house. Added to the above-mentioned dust, such intense drought is certainly injurious to the respiratory mucous membranes; whether it favors the development of adenoid hypertrophies is still an open question, but I am inclined to agree with those who answer in the affirmative; the sudden increase in the number of rhinitis cases, when the furnaces are set going, is so striking as to make some sort of etiological relation highly probable.

It is not easy to suggest an adequate remedy for this defect of the hot-air furnace; the air passes through far

[1] A house measuring 60x60x23 feet contains 3,067 cubic yards, ¼ ounce of water per yard equals six gallons.

[2] Journ. of the American Med. Association, November 9, 1895.

too rapidly to take up its proper quota of watery vapor in transit, even were it supplied. A larger furnace, with a slower air current, would entail increased expense, even if otherwise practicable.

Heating with low-pressure steam has for many years been steadily gaining favor, and has monopolized the field in cool and cold climates, for all large buildings. The steam-heating plant has the great merit of sufficiency, which readily passes into excess on mild winter days, as well as in autumn and spring, when steam-heated apartments are invariably too warm. The attempt to correct this overheating by means of direct ventilation through open windows is very apt to create draughts that are the more dangerous because of the overheating. An additional drawback, of no little consequence, is the dissociation of the heating and ventilating plants; our engineers and architects have hitherto not succeeded in devising a good independent ventilating apparatus, and the air in steam-heated buildings is rarely as pure as one would desire.

Heating with hot water does not differ essentially in principle from the preceding; it has found little favor in this country, and seems inadequate against the intense cold of our northern winters; in England, where severe winter weather is exceptional, it has come into use more generally.

Turning to the subject of ventilation, we find that it resolves itself chiefly into the management of windows and doors. With the prevailing style of American window, consisting of upper and lower sliding sashes, the admission of air from without can be regulated almost to a mathematical nicety, if the counter-openings of doors

and flues and the direction and force of the wind be carefully considered. As a general rule, when the wind does not blow toward the window, opening at the top merely permits the egress of warm and respired air, the deficiency being made up through the door and furnace, also the fireplace, when not in use. Under almost any other conditions, air will enter through the window; such is the case when the lower sash is open, or the fireplace is in use, or when a fairly strong breeze blows toward the room. It is a popular fallacy, readily exposed on any cold and windy night, that lowering the upper sash a few inches invariably contributes only to the exit of foul air; under the conditions just mentioned the air current is exactly in the opposite direction, and a cold draught descends from the top of the window to the floor, very much in the manner of a waterfall. It is therefore extremely hazardous for a person, unaccustomed to this sort of exposure, to sleep directly under an open window, even if carefully covered.

I mention the above practice and condemn it merely in passing; it is one of the pet measures of the advocates of hardening, which may be indicated in adults suffering from chronic tuberculosis of the lungs, but need not, therefore, be prescribed for children in the offhand routine fashion nowadays so popular with many physicians who read much but reflect little. Similar errors will recur from time to time as we go on, and similar observations will have to be made repeatedly.

The weather strip has been commented on rather unfavorably in recent years, but it is hard to see just why; it seems to me that a window may as well shut tightly, if it is to be closed at all.

The so-called French window, opening sideways, is inferior in many ways, the main objection being that the influx of air cannot be regulated with any exactness. The installation of a double set of these windows is altogether objectionable, except in regions experiencing intense cold; the single window lets in some fresh air through slight defects in fitting, an advantage lost when double sashes are provided.

Many persons, including some physicians, find it difficult to appreciate the difference between an open window and the open air, though the matter is simple enough. In the former case we admit a draught of usually cold air into a warm and almost stagnant atmosphere, while the occupant of the room is dressed to suit the latter only, and is therefore exposed to the danger of a chill; in the open the temperature is uniform, and the individual concerned is clothed accordingly, while the air currents are diffuse and intermingle freely. It is evident, therefore, that a veranda or open tent involves far less risk than a room with an open window, notwithstanding the apparently greater exposure; it is easy to become habituated to the former, whereas, to a child at least, the latter is always hazardous in cold weather.

From the above remarks, it is plain that the so-called "house-airing," nowadays so frequently recommended as a compromise, to the timid parents of children who would do better outside even in doubtful weather, is no compromise in any sense, but a measure replete with danger; the child is exposed to a cold draught at every inadvertent opening of the door. Throwing open the window wide does not decrease the danger, but merely increases the discomfort to the occupant of the room.

The chamber occupied by a young infant should not be ventilated directly, but through an adjoining room; an exception may be made to this rule, when the outside temperature exceeds 70 degrees, but, even then, care should be taken not to place the child right in the current of air, but to one side. The bedroom of an older child may be ventilated directly, if the following precautions be taken: the bed must not be set under the window, nor against any save a party wall, for the abstraction of warmth through an outer wall, on a cold night, is almost as dangerous as the draught through a window. It is also a good plan to fasten down the bed clothes with safety pins, for some children are in the habit of throwing off their blankets during the night, often with unpleasant consequences. In cool weather the windows of the playroom should be shut tightly, for such cold air as enters is sure to gravitate to the floor; it is a great deprivation for children to be prevented from creeping about on the rugs or carpet, so that this last precaution is quite indispensable.

Housing. The demonstration of the bactericidal properties of sunlight, by Downes and Blunt,[1] was hardly required, to convince us of its supreme hygienic importance; the Italian proverb: *dove no va il sole, va il medico,* expresses the common and correct opinion quite accurately. The exigencies of modern city architecture absolutely ban the direct rays of the sun from some of our rooms, though in northern latitudes, where the sun describes considerably more than a half circle above the horizon during a great part of the year, its rays should enter every window at some time of the day

[1] Proc. Royal Soc. London, 1877, vol. 26.

during May, June and July. This can, of course, occur only where the houses are built widely detached. In the city of New York, the majority of lodgings in the flat and tenement houses have but one sunny room, which is usually not a bedroom; the advantages of a climate, that in wealth of sunshine fully equals "sunny Italy," are thus almost entirely thrown away, merely that landlords may enjoy greater rents, and see real estate values rise. In most other American cities matters are somewhat better, though too often only in the quarters inhabited by the well-to-do; in our small towns conditions in this respect are quite good, save for some bungling architecture that has planned unnecessary dark nooks and corners.

The housing conditions in cities like New York are about as bad for children as can be imagined; to this we may add, during the colder months, a certain proportion of inclement weather which is less in evidence in equally crowded cities in milder regions, for instance, Naples. It is really remarkable that our city children are not more flabby and pale than we find them; that actual conditions are bad enough is seen in the report of the Chief Medical Officer of the New York Department of Health on the examination of school children.[1]

The only compensation for adverse conditions, such as these, is to take the child into the open air as much as possible, and to select the sunniest places, save during hot weather. It would seem absurd to add that this does not include exposing the baby's eyes to the direct rays of the sun, but a ten-minute walk through any of our parks will furnish abundant evidence that this hint

[1] New York Med. Journ., Aug. 12, 1905, p. 343.

is not superfluous; the heedlessness of many mothers and nursemaids is almost beyond belief. Shelter from strong winds is also important on these outings, and it is hard to determine whether the cold and dry "mistral" type, or the strong damp sea breeze of April and May, is the more deleterious; my experience, however, inclines me to regard the former as the worse, since it brings severe cold with it, and is of generally greater violence. In very severe weather, exposure to sunlight indoors, when available, must often suffice as a substitute; careful adjustment of clothing is, however, of some importance, for the sunlit portion of the room is apt to feel very warm, on account of the radiant heat, even when the room temperature is at 70 degrees or below.

I have not found it necessary to draw a line on the thermometer below which an outing is barred. Holt keeps young children indoors when the outside temperature is below 20 degrees; in my own experience I have seen infants above six months old exposed to far colder weather, the sunny and sheltered side of the street being chosen for the airing, and am convinced that no harm was done. It is, after all, a matter of habit; cold that is considered intense in New Orleans is deemed very moderate in New York, and passes for a harbinger of spring in Montreal. At the last-named place, drawing the line at 20 degrees would practically mean imprisonment during most of the winter; in New Orleans it would mean exposure to all sorts of temperature changes in that most erratic winter climate. It is probably wisest not to draw any line, but to use one's judgment as wisely as possible.

Clothing. We may now take up the subject of clothing;

I confess to doing so with considerable diffidence, and feel that the divagations of Herr Teufelsdröckh are nearly as useful as the latest manual of hygiene. Who will, for example, account for the fact that most adult males wear woolen underwear, whereas the so-called weaker sex deems cotton sufficient; yet both are liable to illness in about the same ratio, if indeed the male sex is not a little more susceptible? Man covers the chest and exposes the throat at all seasons; woman covers both or neither, regardless of the season. In my dispensary service the children suffering from bronchitis wear all the way from two to seven layers of clothing, plus or minus a red flannel chest-pad. I fear that the truest expression of our information on the subject is a mixture of empiricism, tradition, hearsay, prejudice, fashion, eccentricities, dogmatism, nihilism, and a very moderate proportion of physical and physiological facts. It will take but a few lines to state what is practically useful and scientifically established.

For deficiency in clothing there is one infallible test, particularly trustworthy in children, namely, coldness of the extremities in spite of a sufficiently high temperature of the room; there is an equally accurate criterion for overdressing, namely, sensible perspiration, for the hyperidrosis common in neurotic adults is not often a source of confusion in early life. Many parents are strangely disregardful of the comfort of their children in this respect; young infants are apt to be overdressed, the coverings suitable to a surrounding temperature of 70 degrees are kept on in the hottest summer weather, so that an acute dermatitis is added to the ordinary distress occasioned by the hot spell; after the age of

three or four years too light clothing is commoner, and I have frequently seen children suffer intensely from the devotion of their parents to some such fad as the bare extremities fashion which is now particularly rife.

As to the proper material for clothing children, there is at present a lively controversy between the advocates and adversaries of hardening. For young infants wool is generally recommended, on account of its being a relatively bad conductor of heat; on this subject some curious delusions and prejudices prevail. In the first place, wool ranks only a little lower than cotton as a heat conductor, and the low conductivity of most woolen goods is due to their loose texture and the air, one of the poorest conductors known, entangled in their meshes. Cotton goods of loose weave, such as Canton flannel, will be found to give nearly as great protection, and to have several advantages; for the rough edges of the wool fibers irritate the tender skin of the infant, as well as of many older children, and the thorough cleansing of woolen clothing is relatively difficult on account of this same roughness. Unless carefully handled, woolen fabrics tend to become felted in the laundry, thereby becoming hard and markedly increased in conductivity. It is probable that a mixture of wool and cotton is best suited to the purposes of underclothing. For outer garments the above objections to wool do not, of course, obtain, and it is to be preferred in cool weather, at all events. Every observer will, however, notice, how the small boys always wear ostensibly woolen suits, and the little girls usually cotton fabrics, while the one sex seems to get on about as well as the other.

Looseness of adjustment is an important desideratum

in the clothing of children, but has no special connection with the question of warmth or coolness, unless actual constriction takes place. The question of partial nudity will be taken up in our discussion of hardening, in a later paragraph. The matter of the color of clothing involves a number of refined points in physics that are not always clear and usually disregarded; as an instance I may mention that recent studies in radiology seem to demonstrate that red is the best protective color against the summer sun—the summer dress of most mammals is reddish brown—the mere suggestion of this would have been considered absurd a decade ago. The best color in winter seems to be black in the sun, and white in the shade, which suffices to demonstrate the impracticability of carrying out any rule on this subject.

The data just given amply illustrate the uncertainty of the relations of clothing to climatotherapy, and account for the supremacy of fashion over hygiene in this field; the only point on which we can depend with some assurance is the quantitative factor, and we instinctively feel that we have done everything when we recommend light weights in summer and heavy ones in winter.

"*Catching Cold.*" The older authors attributed most acute, and many chronic diseases to "catching cold," that is, exposure to a sudden fall of temperature or a chilling of the body after previous warming. This belief began to lose ground under the influence of bacteriological research, and reached its minimum toward the turn of the century, when many of the most competent clinicians regarded it with the greatest skepticism. Meanwhile investigations have been conducted, to settle

once for all whether the old creed is to be definitively abandoned, or merely revised to suit modern scientific standards.

As far back as 1872 Rosenthal[1] showed that animals warmed to a temperature of from 104 to 111 degrees assumed a subnormal temperature on ordinary exposure to the air. This experiment was supplemented by Affanassiew,[2] who cooled animals with the ether spray; so long as this cooling did not exceed a few degrees, no permanent effect was produced; when, however, the animals had been cooled off 20 degrees, many died in about 24 hours, exhibiting on autopsy cloudy swelling and granular degeneration of the hepatic and renal cells and the heart muscle, lesions which had often been referred to "colds." Control experiments were made by merely warming the animals to 104 degrees; no morbid changes resulted. Affanassiew's experiments were varied somewhat by Lassar,[3] who employed the ordinary casualties of everyday life. He dipped rabbits, which had been kept at a temperature of 95 degrees, into ice water, then exposed them to the ordinary temperature of the room; within a day or two fever and albuminuria developed, of which the latter proved fatal in some cases, and led to chronic renal disease in others. There is some analogy to human disease in this process, but also an important difference; a cold in man is far more apt to entail a pulmonary than a renal affection, and few investigators have succeeded in causing respiratory disease in rabbits by this method. One circumstance, of course, must not be disregarded,

[1] Berliner klin. Wochenschrift, 1872, No. 38.
[2] Centralblatt für die med. Wissenschaften, 1877.
[3] Virchow's Archiv, vol. 129.

namely, the wide gap between rodents and primates in the mammalian scale.

Valuable information has been contributed by Nebelthau and Zillessen.[1] Nebelthau found that the employment of ice water is unnecessary; a mere thorough wetting of the animal's fur, and exposure to a strong draught of air as warm as 82 to 86 degrees, sufficed to produce hyperæmic lesions of the stomach and pulmonary lobules; some of the animals died within 6 to 12 hours, but their death was not intimately connected with the stated lesions, which were not very extensive. Zillessen ascertained, with positiveness, that no true pneumonia was developed; he again found renal lesions with relative frequency.

The net result is that in many animals, notably rabbits, exposure to the thermal shocks that are supposed to cause acute respiratory diseases in man produce no such effect, but provoke hyperæmia and degeneration of the kidneys, which sometimes prove rapidly fatal, but not in a way similar to anything occurring in the human subject. The injuriousness of such exposure is clear, its modus operandi is not yet determined so accurately as to be immediately applicable to human pathology, and we must still content ourselves largely with inferences. As to the individual variations, we know very well that, among human beings also, some are proof to thermal influences that would almost surely prostrate others.

Even if preliminary overheating is not essential, there is overwhelming clinical evidence that it materially increases the liability to take cold. There is also no

[1] Inauguraldissertation, Marburg, 1899.

doubt, as already suggested in the first chapter, that the resistance of the organism to thermal shocks is seriously impaired by having been accustomed to a temperature even slightly above the indifferent point; this is the condition concisely but not quite accurately designated enervation. Then, of course, we may add other debilitating circumstances, such as general malnutrition and chronic visceral disease. Finally, we must not lose sight of the relatively low resisting power of childhood, shared, incidentally, with old age; not only is this shown, as explained before, in the elevation of the indifferent temperature during early life, but it appears quite as conspicuously in an increased sensitiveness to changes, and a greater tendency to undergo enervation under a pampering regimen.

The most active resistance to the whole theory of catching cold, as here outlined, has come from the bacteriologists; yet they have contributed some of the most valuable evidence in its favor. Pasteur[1] increased the susceptibility of fowls to anthrax by cooling them in a bath at 77 degrees, but his experiment is not perfectly applicable, because of variations easily introduced into the biology and culture of the anthrax bacillus; objection might therefore plausibly be raised by the opponents of the "cold" hypothesis. Lode,[2] however, seems to have fully proved the increased susceptibility induced by draughts of cold air, especially after a wetting (increased radiation of body heat); the animals thus exposed succumbed readily to infections to which unexposed animals were far more resistant. We cannot

[1] Bulletin de l'académie de méd., No. 12.
[2] Archiv für Hygiene, 1897, vol. 28.

therefore doubt that exposure to cold, when the normal vasomotor compensation is interfered with, as after a wetting, or when it functionates inefficiently in consequence of enervation, renders the organism very much more susceptible to bacterial infection, with more extensive or intensive development of the contracted disease. We also see that the necessity of allowing for the presence of pathogenic micro-organisms does not affect our main proposition, for some of these microbes, for example the streptococcus or pneumococcus, are practically omnipresent.

Hardening. The connection between catching cold and the prevention thereof is presented in telling fashion by Kisskalt,[1] who lays down the following propositions: First, the tendency to disease is increased by arterial hyperæmia, best illustrated by the condition popularly called overheating; secondly, the contraction of the blood vessels through the external application of cold (withdrawal of heat) causes an internal hyperæmia, pathologically not to be distinguished from the congestion that forms the first stage of an inflammatory process, requiring, in fact, only the presence of bacteria or their products, to pass into that stage. Kisskalt's third proposition refers to the circumstance that habituation to thermal shocks diminishes the contraction of the cutaneous vessels and the secondary internal hyperæmia; we therefore catch cold only when some part of the surface of the body has been chilled, and can reduce this reaction to surface chills by habituation. This process of training the cutaneous vasomotor apparatus, so as not to react violently to every outward thermal influence, is

[1] Archiv für Hygiene, vol. 39, No. 2, p. 142.

commonly designated as hardening, and the next few pages will be devoted to a careful consideration of this mode of habituation as applied to children.

It was a natural and logical trend of thought that led from the steadily increasing enervation due to our modern exceedingly high standard of comfort, with the attendant risks just outlined, to the diametrically opposite system of physical training. Hardening is normal in the savage and barbarous races; the resisting power of the Red Indian, scantily clad as he is or rather was, to the vagaries of the American climate, had always evoked expressions of astonishment and admiration on the part of the "palefaces," and the tendency arose in many quarters to bring up the white child in the most Indian-like manner compatible with the higher civilization.

The promoters of this idea lost sight of a crucial fallacy, which has totally invalidated their argument. As a matter of fact, while the Indian does well enough in his primitive state in the lower stages of barbarism, he stands civilization very badly, becoming excessively subject to the white man's diseases so soon as he adopts his habits even in a modified degree, being, in particular, notably prone to tuberculosis. Countless generations of hardening have, in his case, been of no avail in counteracting the enervation incidental to our civilization, and its after effects. Still, the experiment has been given a faithful trial, and, from early infancy onward, children have been exposed to wind and weather in the hope of avoiding the enfeeblement of the normal resistance that follows pampering and coddling.

It is unnecessary here to enter minutely into the

history and details of the hardening movement in pediatrics; failure of the milder methods gradually led to increasing strenuousness, until the most popular procedures attained the degree of severe physical torture, such as only an intimidated and helpless child would tolerate. Frequently repeated cold baths and insufficient clothing came into vogue; running about barefoot, in and out of doors, ranked among the milder and therefore more amusing measures. It is only necessary to glance at the recommendations of Hochsinger,[1] who lays claim to conservatism, to see how even cool-headed practitioners have been carried away by this monstrous fad, for it is nothing more.

For all this enthusiasm, to which the comfort and happiness of countless children have been sacrificed, we can record nothing but still more failures; the young victims continued to catch cold at least as often as before, and in addition developed other weaknesses which were actually rarer before strenuous hardening became the fashion. Fortunately, the movement had to come to a halt at this point, because it was physically impossible to push the theory of hardening any further.

The truth of the matter seems to be that any hardening that is at all feasible under the conditions of our civilization is bound to be imperfect; furthermore, there is great risk of overstimulating and thereby exhausting the thermoregulatory centers if an excessively strenuous system be followed; we find a parallel to this in the "going stale" of overtrained athletes. There seems to be a limit to which the endeavor to inure the organism to thermic shocks can safely go, and beyond which it

[1] See bibliography.

cannot be forced without a reasonable certainty of disorganizing the whole apparatus. This danger line is reached far more readily in children than in adults; in the case of young infants this has indeed usually been recognized, and only the most rabid advocates of hardening ventured to apply their methods to the first year of life.

Hecker[1] was the first to call a halt to the votaries of strenuousness; he found that, among his clientèle, the rigorously hardened children were just twice as likely to catch colds as the totally unhardened, and that the moderately hardened children occupied an intermediate position. The hardened children had, moreover, a marked tendency to neuroses and anæmia, and nearly always gave the impression of being "delicate." Special stress had been laid on hardening as a preventive of adenoid hypertrophy in the naso-pharynx and fauces; Hecker found this lesion in 40 per cent. of the hardened children, but in only 20 per cent. of the unhardened.

Hecker's observations have obtained ample confirmation, and have, of course, been vehemently attacked by the radicals; fortunately, it is most easy for any practitioner to satisfy himself as to the leading fact, that the coddled children are not any more susceptible to respiratory affections than the hardened ones, while those who are handled with ordinary intelligence, rather than dogmatism in either direction, seem to thrive best of all. The final result, suggested at once by common sense, is as follows: Young infants should be treated with the utmost care to avoid anything like severe exposure; after the first year gentle attempts should be made in

[1] Münchener med. Wochenschrift, 1902, No. 45.

the way of a more strenuous regimen, but children under six or seven years always demand complete protection against cold and wet. With the commencement of school life a little more latitude is necessary, and may be permitted; dry cold may be disregarded, whereas dampness and chilliness still call for due precautions. Full exposure is only to be thought of after puberty, and here, too, we must beware of routine, for, as a consequence of centuries of civilization, with its ample provision of shelter and artificial heat, many individuals are affected with what may be called hereditary enervation. Such persons are and remain sensitive to sudden temperature changes, and it is quite impossible to habituate them to conditions that are regarded with indifference by the wild Indian. On the whole, however, the power of resistance usually increases up to the thirtieth year, to decline again at the onset of senility; thus, a course of hardening which would be absolutely harmful to a young child may very possibly be suited to an adult enervated by a hot climate, dissipation, or general hygienic neglect.

Hecker has appended to his admirable critique certain recommendations which embody his idea of a rational course of hardening. He seems, withal, to stand in some awe of the radicals, for I should say that even he advocates a régime that savors of excessive strenuousness in a number of minor details, as will appear in the following review of the several points that he enumerates:

In the first place, he advises us to begin by accustoming the child to the bedroom temperature, allowing it to run about barefooted or even nude before being tucked in. This suggestion sounds a little strange from an

opponent of severe hardening, more especially from a resident of Germany, where the customary temperature of the bedroom is lower than with us, namely 60 to 64 degrees. Even an adult cannot remain stripped at any such temperature without shivering violently after a few minutes, and most of his body is at a greater distance from the still colder floor. The room temperature is usually taken at about five feet of elevation, but in winter, even when artificial heat is supplied near the floor, the lower strata of the room atmosphere are from four to six degrees colder than indicated at the usual level of the thermometer. It is evident that no child should be permitted to play on the floor of its apartment in a partially or wholly undressed state, except during the warmer months of the year. Hecker's first proposition is only a shade less objectionable than the cold baths he so justly condemns.

His second recommendation, to take the child out of doors after the age of six months, unless the weather is very cold or stormy, I have already indorsed; when, however, he advocates the removal of shoes and stockings in summer, even the so-called summer of Munich, which resembles the latter half of May in New York, he seems to be conceding too much. Aside from the possibility, in fact likelihood, of traumatism in this age of tacks and broken glass, it is, to begin with, unsuited to even a warmer climate, except indoors in the hottest weather, and is, furthermore, unpractical as a measure of training, since the prevailing standard of civilization requires its abandonment in later life. Unless fashion will permit adults to go about barefoot it is hard to see any real purpose in this mode of hardening.

Hecker's third recommendation, to avoid the use of furs, and to leave the throat bare, is quite proper for a climate such as that of Germany and our middle and southern states; it must, of course, be abandoned in regions where temperatures below zero are frequent. A modicum of common sense will solve this question without difficulty. As to his suggestion to leave the legs and arms bare, objections will occur to us at once. This curious fashion has no special effect, except to facilitate the work of biting insects, and subject the exposed extremities to an infinity of annoying cuts and scratches, with more or less risk of septic infection, besides leading to painful sunburn under appropriate conditions. Thin coverings are almost as cool as nudity and afford protection against the injuries mentioned. I might add that, even in our middle states, the summer is not adapted to exposure of this kind save during exceptionally hot periods, and I have seen small children undergo severe suffering on cool summer evenings, simply because their parents had semi-barbaric tastes in dress, at least as far as their offspring were concerned.

As to Hecker's recommendations on the subject of hydrotherapy, I may say that I quite agree with him when he prefers cool sponging to immersion, and uses the sensation of the child as a guide; if it enjoys the process there can be no objection, and this will usually be the case if the room be carefully warmed and the child permitted to stand in a few inches of warm water. Strenuous objection on the part of the child makes the advisability of any but tepid baths (86 to 90 degrees) doubtful, and I would not recommend sponging with water colder than 68 degrees, even for the most robust;

the reaction should be watched closely in every case, and its absence noted as a positive contraindication.

Strenuous hydrotherapy has been the main reliance of the advocates of hardening and the most prolific source of mischief; the more radical advocates of this discipline abstracted the necessary body heat from their young victims by plunging them into tubs of cold water two or more times a day, and then wondered why they caught cold even more frequently than admittedly pampered children.

Hecker's final advice: to harden gradually, to individualize, to wait until the age of two or three years before beginning, and to take special care with anæmic and neurotic children, cannot be followed too conscientiously. I would add that we might, in general, harden children even a trifle less than permitted by Hecker; he himself noted that moderately hardened children showed a higher morbidity than those not hardened at all. I do not, of course, mean thereby that children are to be pampered and coddled, and guarded from every breath of cool and fresh air as if it bore contagion, but am fully satisfied that, in this field, too little is better than too much; a manner of living that lends robustness after puberty is not for that reason suitable to an earlier age; the young organism is far more delicate, and has in particular a smaller caloric reserve. This last is shown by the great tendency in childhood to cold hands, feet and ears, and frostbites of every degree, including the annually recurring winter eczema of the face and hands; it is high time that the fact were universally appreciated, that not only infants, but older children in a gradually diminishing degree, are intolerant of low temperatures.

Summer Resorts. From various remarks in this as well as the introductory chapter, the reader may have gained the impression, which is strictly correct, that occasional moderately hot weather, say 85 degrees of heat with less than 70 per cent. of humidity, otherwise a sensible temperature under 77 degrees, is not in itself injurious to the very young, though it may be trying to their elders, who are obliged to dress according to convention, and work for a livelihood besides. It was shown at the outset that, with proper general hygiene as to pure air and clean food, there is no occasion for an especially high infant morbidity and mortality during the ordinary summer weather of our northern cities, while in the country districts the summer should be conspicuously the most healthful season. It has, in addition, been noted that infants do not do much worse in our southern states, where the cities are relatively small, with detached houses and plenty of shade out of doors, provided that the milk supply be of good quality. The matter of milk inspection, in its many aspects, does not concern us here; we have therefore to consider mainly the question of fresh and pure air, which by itself will guide us readily and sufficiently in the selection of a summer resort for young children and infants.

Nearly all our country places, except the very hot ones, are beneficial to infants, who thrive luxuriantly in localities where their elders pant with the heat and humidity. There are, however, some factors that may aid us in the choice between seaside and inland resorts, the question that perennially is brought to the attention of the family practitioner, and that he must solve in an intelligent manner. As we have already considered a

large mass of climatological data concerning individual localities and districts, it remains for us only to generalize as to climate, and specialize as to the patient, and we surely ought to be in a position to select wisely and with good reasons.

Seashore Resorts. During the child's first summer, the seashore meets the desirable indication of an even temperature. A good sea breeze, bringing the pure ocean air, tempers the heat of the day, and the fall of the thermometer at night is relatively very small. A rather high average temperature, as we have said, offers no objection, and the somewhat sultry summer of Long Island and New Jersey seems to be the very thing for young infants, superior to the very cool, sometimes almost raw, summer climate of eastern Maine and Nova Scotia. At the same time an excess of windy weather is to be avoided; such places as Block Island are perhaps a little too much exposed; the infant must be kept indoors rather frequently, even on some tolerably bright days; this seems like a waste of good opportunities. The sea fog is, of course, to be shunned; it increases in frequency toward sunset, and as we go northeastward, and furnishes another reason for preferring the Middle Atlantic Coast to that of northern New England; for this cause also, the entire Pacific Coast north of Santa Barbara is objectionable, not to speak of the very low temperature that prevails everywhere. Residents of the North Pacific States and the greater part of California cannot take their young infants to the seashore with advantage, but must select sheltered semi-inland localities, where the violent ocean winds and fog rarely penetrate. Among European coast resorts, those of France

are unquestionably the best: the English and German seaside stations are rather chilly, those farther south too warm and usually malarious.

During its second summer the infant no longer demands a high temperature so imperatively, and the cooler seashore localities may be chosen with as good results as those of the Middle States. In Europe the south coast of England and the Baltic coast of Germany are highly salubrious for older infants, while the shores of the North Sea, being more subject to damp winds and fogs, are better adapted to children past the age of infancy. The last remark also applies to the Middle and North Pacific Coast in our country, some parts of which are, as a matter of fact, too rough for all save the hardiest adults.

Inland Resorts. The inland resorts best suited to very young infants are usually felt to be a little too warm by older persons; examples of these are the river valleys from the Merrimac to the Susquehanna, which are quite free from really cool nights during July and August, and experience a large number of rather hot days. In the second and third summer we may, therefore, with advantage, select cooler situations, provided that certain precautions are taken in the avoidance of isolated peaks, which are apt to be relatively windy, and are often shrouded in clouds when the weather round about is fair. Deep valleys and especially hollows are very objectionable, as they are subject to dampness, sultry days with a sudden fall of temperature at night, heavy dews and early frosts. While under the head of ordinary inland resorts we include elevations up to three thousand feet, we must exclude a number of places

below this level from the treatment of very young children. Among these moderately elevated localities, where the average temperature in summer is below 62–64 degrees, and the nights are sometimes frosty in late August, we may include the highest villages and hotels of our northeastern hills, and still more the mountain regions of northern and central Europe, such as the Scottish Highlands, and the upper levels of the Harz and Black Forest. These regions are too cool for children a year or two old, who may be deprived of many an outing on days that are raw and windy, but quite dry; every dry day on which a child must be kept indoors is a day lost. With proper exposure, preferably on the south side of a gentle slope, the above-mentioned mean temperature is a pretty safe guide, but naturally summers differ somewhat, and a resort that is fairly mild in a summer like that of 1901 may be very chilly in a season like that of 1903, the difference for July and August having been about five degrees in the northeastern states, and considerably more in the West.

After the second year, when a mild degree of hardening may be advantageous, we may avail ourselves of the cooler inland stations, but a certain amount of individualization is in order. Robust children do well at these resorts, but delicate specimens require more careful handling, and it is advisable to keep them in a rather warm summer climate a year or two longer. It is true that climatic hardening, administered during the warm season, is a very mild form of physical training; this fact, however, must not invite recklessness, and it will generally be found that the child, that has undergone the least strenuous exposure to the elements, returns

home in autumn in the best condition. Still, I would not be understood as favoring a régime of coddling with advancing years, and consider a mild form of climatic discipline one of our best means of educating the young organism to withstand the physical strain that will befall it in later life. A few years later, say after the age of five, the moderate amount of exposure involved in a stay in a really cool summer resort is almost imperative; older children undoubtedly profit more by a few months' residence at the cooler hill resorts than by being sent to warmer localities, especially at the seaside. Whether the cooler maritime stations, such as those of eastern Maine, are or are not as beneficial as the White Mountains or Adirondacks, is hard to determine, and individual idiosyncrasy undoubtedly plays a part; my experience, however, convinces me that the majority of children profit more by inland climates, for there is an excess of dampness and fog at the colder seashore stations; during warm spells there may be a few sultry nights even well to the northward along the coast, whereas uncomfortable nights, when blankets are a burden, are practically unknown at even moderate elevations in our northeastern mountains.

Elevations. We have seen that an elevation above 3,000 feet is not contraindicated *per se* in infancy and childhood, but the temperature conditions at high levels are not often suited to young infants, so that these resorts are better reserved for the third summer and thereafter. Even then the European high Alpine resorts are rather too cool, the temperature averaging below 60 degrees even in July, and there is often a large number of chilly and rainy days. These disad-

vantages do not obtain in the greater part of the Rocky Mountain region; children tolerate the rather warm, but very dry and sunny days particularly well, and find the cool nights exceedingly refreshing; the necessary hypertrophy of the blood, shown in the increase of corpuscles and hæmoglobin, is effected with relatively great ease in the youthful organism, being completed within three weeks without the manifestation of any noteworthy strain on the system.

We must not fail to note, however, that the above remarks apply strictly to normal children; in a number of the less conspicuous chronic disturbances, the high mountain resorts are far from beneficial; the higher Alps, also, are adapted only to older children, who can be out of doors during the frequent spells of rather autumnally cool weather. The nights in the valleys of the upper Alps are very apt to be damp, with heavy dews, and frost often attains a measurable thickness in the middle of summer, as I can testify from personal observation. This sort of outing involves a fair measure of hardening, and cannot be recommended where there is any suspicion of a delicate constitution, or where the general nutrition is below par; it will be found that children thus afflicted experience considerable physical discomfort, lose sleep and become restless, so that latent neuroses are very apt to become manifest during or shortly after a summer spent under the stated conditions.

Winter Resorts. In the selection of a winter resort for children it is well to set out with the understanding that no attempts at hardening should be made at this season. Even in climates that border on the tropics, the winter

months are characterized by marked and relatively sudden temperature changes, frequent frosts and occasional snow, save where the mean temperature is almost summer-like. It seems hardly worth while to transfer a child to a climate that differs from that of its native surroundings only in a moderate degree; transportation from Boston to Washington, for instance, affords merely a rise of some half-dozen degrees, without any noteworthy change of the climatic type.

One point, however, in which temperature does not play à part, is well worth considering. For example, we see that the winter months in 1901 furnished 56 cloudy days at Buffalo, but not a single clear one, the other 34 being partly cloudy; whereas the same period at Atlantic City embraced 32 clear and only 22 cloudy days; the days with rain or snow numbered 79 at the former place, only 26 at the latter. A change from Buffalo to Atlantic City cannot but be beneficial, and the difference in temperature, seven or eight degrees, becomes altogether subordinate to the gain of 53 dry days, and a difference in cloudiness of thirty per cent. It is a fact that a number of points in the Lake Region afford young children hardly any good weather for an airing during the winter, and the extreme northwest coast is not much better in this regard, and in some respects worse, for the endurable light snows of the Lakes are there represented by drenching rains. Some of the points of northeastern Canada also suffer from bleakness, and the interior from New England to Indiana ranks only moderately high as to the number of fine and bracing winter days. With older children, therefore, say from two to six years of age, who are not suffering

from any distinct morbid condition, but still seem to require more fresh air and outdoor exercise than they can get at home, the moderately cold resorts of the Atlantic coast, from Long Island to Virginia, may be employed with distinct benefit.

Apart from the consideration just noted, we need pay attention only to such winter climates as have a decidedly spring-like temperature and plenty of sunny days; we shall see that readily accessible places fulfilling this requirement are not very numerous, but may begin with the best, and then consider those that are only tolerably good, but nearer at hand.

Almost the only perfect winter climate for young children and infants is that of southwestern California; as stated before, it resembles the New York October, but is even a little brighter, with just enough rain to lay the dust, a few rather warm afternoons, and as many light frosts. At San Diego and Los Angeles the winter usually comprises about 45 clear and only 15 cloudy days; rain falls on 20, but generally for a few hours only. We see that even tender infants need be kept indoors only exceptionally, older children only when rain is falling.

The warmer stations of Arizona, even aside from the inferior accommodations, are hardly so good; the extremes of temperature are greater and there is an excess of dust. On the other hand, there are very few days indeed on which children of any age must be kept in the house, and older children are almost certain to derive benefit from a brief stay in this section, especially when a really dry climate is indicated for any reason.

Among foreign resorts the south coast of Spain,

Sicily and Algiers are not very inferior to southwestern California, but the accommodations and surroundings are not quite so good. For a very dry winter climate, middle and upper Egypt are perhaps rather better than Arizona.

It is unfortunate that all these resorts of the first rank are removed from most of our great centers of population by a distance of from 2,500 to 6,000 miles, thereby involving a fatiguing trip and a high cost of transportation. We are therefore obliged to consider some places that offer a more or less imperfect winter climate, and may begin with our very accessible southeastern states.

The merits and demerits of Florida have already been fully discussed; we have noted that removal to the very warm, though changeable, winter climate of southern Florida requires extreme precautions with regard to a gradual return northward, which in the case of infants and young children should in no case take place before April, an intermediate station being selected for the early spring. From Charleston to northern Florida we have a winter climate too much like the northern April to be recommendable, unless a certain amount of hardening is an object, as is the case only in older children who are fairly robust. For a visit to our entire Southeast, it is necessary to take along summer clothing, as well as quite heavy winter wear, and frequent changes from the one to the other are required in the more erratic seasons, as March and June weather alternate. It is thus seen that the climate of this region has but a limited applicability to childhood, and is defective in many respects.

As to the Upper South, the general indications are

similar to those of the Middle Atlantic Coast, but the winter in the former region is hardly so sunny, and more subject to excessive temperature changes, therefore affording no advantages over the latter. The sheltered localities in the southern Alleghanies, however are of some value, and we may say a few good words for the pine belt of the Carolinas. This entire section, like the Middle Atlantic Coast, is suitable only for older children, who either are quite robust, or only require toning up; and we may generally regard these resorts as a sort of makeshift, balancing their accessibility against their unquestionably second-rate merits.

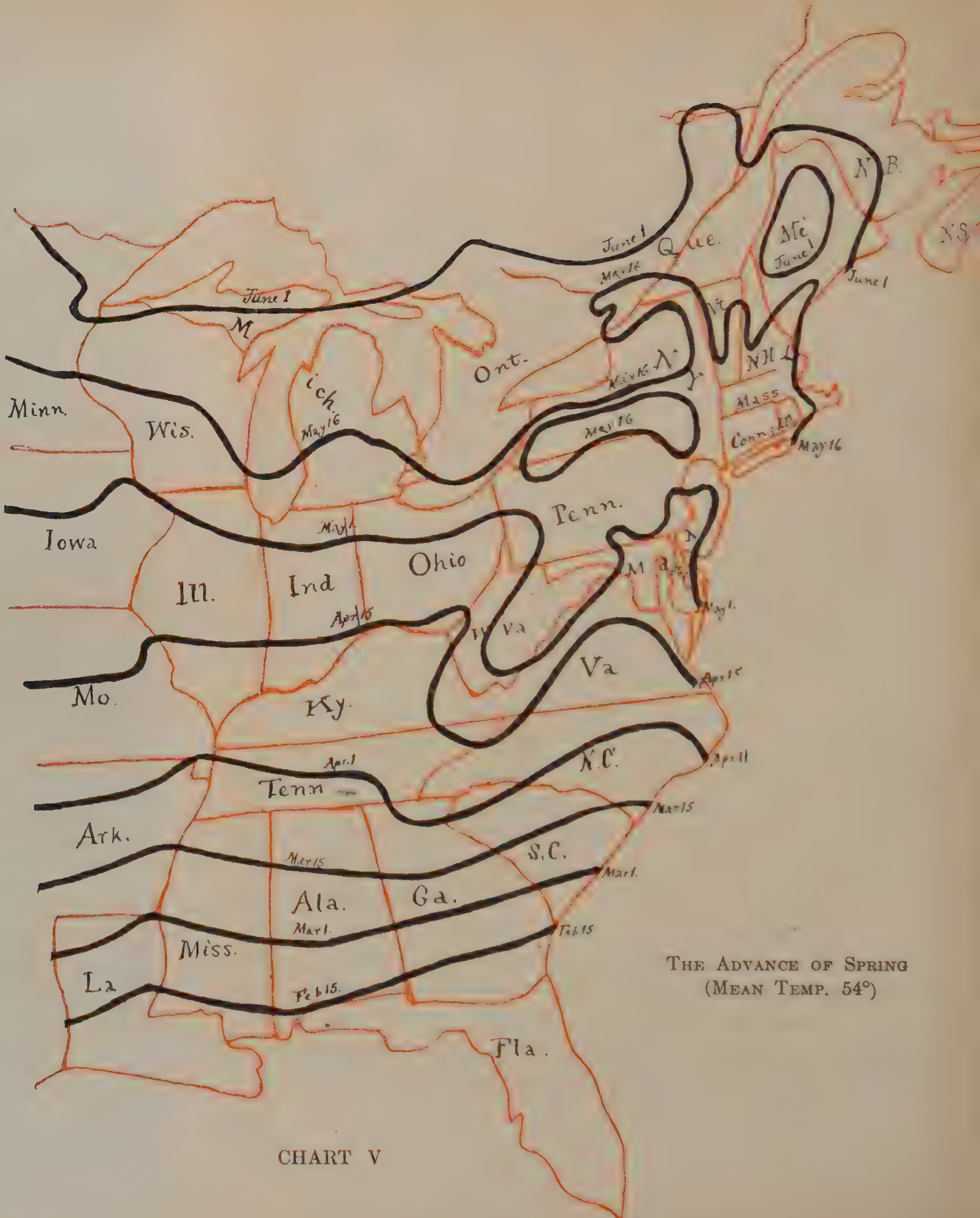
The last remarks apply equally to the Atlantic Coast of Europe, which is not very warm, though quite equable, and altogether too cloudy and stormy. Good results are said to be achieved so far north as the North Sea resorts of Germany; they have indeed the mildest winter of that country, the temperature being similar to that of Cape May, but far less changeable. It is evident, however, that in these cases convenience of access has been deemed a compensating feature. The stations on the southern slope of the Alps belong to the same category, there is still a great deal of rather cold weather and some snow, atoned for, it is true, by ample sunshine and the rarity of sudden changes.

Certainly the best resort among those of the second class is the Riviera, especially from Nice to Genoa. The temperature is not particularly high, but so even that neither summer clothing nor the heaviest wraps are likely to be called for. This climate involves the mildest possible degree of hardening without any enervation, and is too cool only for the extremely young and delicate,

who have to be handled with care in the best winter climates. Far inferior to this favored strip of country are the popular resorts of the Italian peninsula, such as Naples and its surroundings, Rome, which ranks still lower, and Florence and similar places, which are hardly worth considering at all. Stations subject to the mistral (or bora) are to be avoided entirely: they are trying to the most robust adults, and invariably harmful to children, who might as well remain at home to endure the northwest gales and equally bright sunshine of the New York and Boston winter, and have their home comforts when obliged to remain indoors.

The colder winter resorts, such as the Rocky Mountains and the hill country of central Europe, still more such subarctic winters as prevail in the Adirondacks, White Mountains, Upper Mississippi Valley, and Canada, are not suited to children at all. The dry, sunny, and only moderately cold winter of Colorado is perhaps the least objectionable of these, and may benefit older children, near the age of puberty, who are already endowed with some robustness; the other resorts mentioned are, however, not suited to our purposes in any save exceptional cases; experience drawn from the observation of adults must not be allowed to guide us in the treatment of the young, for the reasons previously given and reiterated.

Spring Resorts. The principles guiding us in the selection of winter resorts apply also to early spring; the uncertainties of the weather in March, northward also in April, are, as before noted, even more dangerous and trying than the more or less uniform, if variable, cold of winter. Such subtropical regions as southern



THE ADVANCE OF SPRING
(MEAN TEMP. 54°)

CHART V

Florida and upper Egypt become too warm by the end of March, but most of our American winter stations, as well as those on the Mediterranean, are really at their best in early spring; semi-southern localities, such as Asheville and the Italian Lakes, are ideal April resorts, whereas such exposed marine situations as Atlantic City suffer somewhat from cool and damp sea breezes, though they have a high percentage of sunny days. Children who have spent the winter in the extreme South are best kept at an intermediate station during March and early April, for the benefit of California or Florida is sure to be partly lost by a too early return to our more northerly cities, even those so far south as Washington and St. Louis; New York City sometimes does not obtain real spring weather until late in April, and the Lake Region and New England until well on in May.

In the accompanying map the average date of the arrival of settled warm weather is indicated, the mean temperature of 54 degrees being taken as the standard. Note the retardation of spring on the northeastern coasts, along the Lakes and in the Alleghanies. The extreme variation from the dates given is about two weeks, but in general it is remarkable how closely they apply, year after year, especially in the North; in Chicago, for example, this average temperature can be counted on, with almost absolute certainty, to be attained in the first half of May; in Philadelphia, in the latter half of April.

It is not easy to strike a balance between the respective merits and defects of seaside and inland resorts in spring. As a rule, the marine localities have a larger proportion of clear weather, but suffer from strong and damp sea breezes, with fogs and low temperatures, in the late

afternoon, sometimes for a week running; in the meantime, the inland stations have more rain, a daily range of temperature that is sometimes enormous, very warm days alternating with frosty nights, and a very much higher average. Stations that are fairly near the ocean front, but not fully exposed to its influence, are perhaps the best of all, since they combine a fairly even and high temperature with relative dryness; among such resorts Los Angeles, Oakland, Cal., Old Point Comfort, and Lakewood may be recommended in this country, and such places as Pau in France and Florence and Pisa in Italy. The ocean effect does not disappear entirely, as we leave the coast, until we come to a mountain range; it may therefore extend, gradually diminishing, fifty miles or more inland, especially on west coasts, as in California and France. The east coast sea breezes are less regular and limited to the coastal zone; the contrast between them and the warm land winds is striking, and the change from one to the other almost instantaneous, attended with the most startling fluctuations of temperature.

What with the climatic tables and the above remarks, including the comments on winter resorts, the reader has been supplied with sufficient data to select a spring refuge judiciously. We need not therefore dwell longer on this subject, but may pass on at once to a brief consideration of the

Autumn Resorts. There is little occasion here for prolonged discussion. The autumn climate, over most of the United States, is all that could be desired, and the invalid will rarely be in position to derive any particular advantage from a change. Some variations,

however, do exist, that are worth noting; they are a consequence of the vast differences in latitude. For example, to the south of Boston and Chicago a portion, at least, of September must be counted as summer, and treated accordingly; north of that line the latter half or even the whole of November becomes quite wintry, though the changeableness that characterizes midwinter does not yet appear to its full and objectionable extent. Autumn is almost everywhere the steadiest season of the year, especially so on the sea and lake coasts, which are therefore pre-eminently desirable as fall stations, northward in early autumn, semi-southern in November. At such places as Atlantic City and the Virginia coast the cold season steals on almost imperceptibly through a succession of bright days, and to a similar degree, but a little more irregularly, this is true on our inland plains. In the Lake Region and the northeastern mountains, however, the latter part of autumn is characterized by increasing cloudiness and a great deal of rain and snow; the same is true of practically all of Europe. Our Pacific Coast varies widely in this respect; in Oregon, still more in Washington, disagreeable weather sets in in October; whereas in southern California summer conditions still prevail, and November is the first month of the so-called rainy season, with a proportion of sunshine that still amounts to 60 per cent.

The above outline will suffice for the rare occasions on which an approximately normal child will require a change of climate in the fall.

CHAPTER V

CONSTITUTIONAL DISEASES

In view of the fact that climatotherapy of necessity belongs, in the main, to the field of general, as opposed to special therapeutics, it is to be expected that its chief sphere of usefulness will lie in its application to constitutional or systemic affections. This is so far the case that the general condition of the patient is usually our best guide in the climatic management of localized diseases as well; these will, however, be referred to in a later chapter, and we shall, for the present, confine our discussion to such disorders as are more or less generalized. In this connection we are emphatically reminded of the general therapeutic principle, that in all save the strictly specific methods, still relatively few in number, we treat the patient rather than the disease; we regard the sufferer chiefly from the standpoint of the physiological norm, and as deviating therefrom according to the nature, extent, and localization of the morbid process confronting us.

Though climatic treatment is, from its very nature, inevitably applied to the entire organism, it may nevertheless be directed toward a definite symptom or symptom group, so that different diseases may call for management along different lines. Truly specific climatic action is, however, practically unattainable; if recent studies have accomplished nothing further than to

disillusion the believers in climate as a true specific, the workers in this field will have obtained ample reward, in having finally set this branch of therapeutics on a sound scientific basis.

In many respects, the preceding chapter forms the best introduction to the present; it not only supplies a general guide to climatic prophylaxis, but also gives a broad outline of the principles that should govern us in the treatment of disease. We have already referred repeatedly to that common source of error, now beginning to undergo correction, which fails to make allowance for the vast difference between children and adults, in drawing conclusions from reports dealing essentially with the latter. The last decade is witnessing a decided change for the better in this respect. Increased attention is being paid to the climatic treatment of children, entirely apart from that of adult subjects; the chief regrettable feature that still remains being the very one-sided geographical distribution of this modern view. Of the really valuable new material, the English-speaking nations, and notably Americans, have contributed little of any moment. The economist and sociologist may applaud or deplore the standstill of the population of France, but the therapist is unquestionably deeply indebted to it for the high development in that country of many departments of pediatrics, our special field having been assiduously and profitably developed by the minute and extensive studies of the French physicians. It is but fair, however, to record the valuable researches emanating from Germany, Belgium, Switzerland, and even Scandinavia, where the question of child conservation is less acute. British work has been rather

one-sided, the separation of the child from the adult having been effected but imperfectly; such countries as Italy and Russia, which suffer severely from chronic disease and disability among infants and children, have hitherto given little attention to our subject, although signs of an awakening are visible. It is to be regretted that this country has done the least of all the more enlightened nations; a number of well tried and elsewhere successful methods have been totally neglected or are only now being considered; the reader will not fail to note the paucity of references to American authors on the pages that follow. It is neither necessary nor desirable to dilate on the causes of our remissness, they will occur to every one who is at all familiar with American public life; its effects are only too readily visible, especially in our large cities, where comments on the physical decline of the rising generation are growing ever louder and more insistent. It may be true that our proletariat does not manifest degeneration to the extreme extent observed in the great European centers of population, but the difference in our favor is not so great that we may any longer point to it with pride; for my part, I confess that it is not apparent to me at all in the offspring of our city slum populace. When we consider the economic superiority of this country, its boundless material wealth and resources, its exemption from the military and social burdens imposed on the citizens of most foreign nations, we cannot but regard the conditions here as highly discreditable, and the general indifference on the subject still more so. It is idle for the optimist to protest that we are doing the best we can; a glance at the magnificent array of public institutions for children in France and

Germany proves that we have done next to nothing, and have not even begun to display a proper amount of interest in that most important of all social questions, the health of our future citizens. It has, indeed, become impossible for us any longer to justify our neglect of those growing up among and about us, afflicted with chronic ailments that are almost untreated here, but would be handled with measurable success in certain countries that we like to regard as effete or decadent.

While we were discussing the climatic management of the normal child in the preceding chapter, the thoughtful reader will surely have been tempted to question whether the children, repeatedly referred to as normal, are so in fact. I freely admit that the moderately subnormal child has been continually kept in view, and a moment's reflection will account for this apparently somewhat illogical position. The unpleasant truth is that our overwrought civilization has reduced the absolutely normal child, at any rate between the first dentition and puberty, to a mere theoretical quantity, an ideal to be steadily kept in mind and worked up to, but without undue expectation of ultimate realization. A normal breast-fed infant is not so great a rarity; artificially fed infants begin to deviate from the strictly normal in the first few weeks. When the child begins to run about, still more after it becomes introduced to life at school, it becomes exposed to so appalling an array of unhygienic influences and infectious diseases, that its eventual development into a healthy and robust adult is really a cause for astonishment. It is perfectly safe to say, without exaggeration, that in our large cities not one

child in ten, between the ages of six and fourteen, is a really first-rate physical specimen. We have learned to be content when children do not actually look or feel ill, and to overlook unwholesome pallor, deficient muscular vigor, or irregularity in the digestive functions; yet we feel that these children occupy the border line between health and disease.

At puberty, very fortunately, nature is apt to come to our aid; there appears at that age a certain accelerated vigor of growth and assimilation which, in many cases, succeeds in overcoming previous physical deficiencies of minor degree, so that perfect hardiness may follow a somewhat delicate childhood, by the time that the eighteenth or twentieth year is attained. It is therefore justifiable for the family physician to hold out hope of the child's ultimately "outgrowing" its defects, when these are of moderate severity, even though such a promise rests on no well-established scientific basis. Matters do not, of course, always turn out so well; in many cases the mentioned physiological acceleration fails of full development, or is inadequate to overcome the preceding impairment of physique; in such an event the organism is in grave danger of a total breakdown. The age of puberty is therefore rightly regarded as a critical one; from it we may date a restoration to normal physical vigor on the one hand, or the succumbing to such affections as tuberculosis, neurasthenia, hysteria, or chlorosis, on the other. It is needless to observe that the final outcome, good or bad, depends largely upon skillful management, but in this the selection of climate plays a relatively small part, and we need not dwell on it further.

We thus see that the chapter on the normal child has become a discourse on the "almost normal," which does not suffer from any specifiable disease, yet enjoys a general state of health that is only moderately satisfactory. It is evident that we may pass all stages from the rather rare perfectly robust boy or girl, through every gradation, to children that are plainly in need of medical attention. Thus we arrive at the consideration of

THE ERRORS OF NUTRITION AND DEVELOPMENT

Simple Malnutrition. Simple malnutrition manifests itself primarily in a subnormal weight; among concomitant symptoms the most striking is hyperæsthesia to cold with a consequent tendency to what may well be called hibernation. The patient is decidedly apathetic and somnolent during cold weather, showing little physical and mental energy and requiring an abnormal amount of sleep; this condition is in marked contrast to possibly normal activity when the weather is warm. Visceral torpidity is also quite regularly associated with malnutrition; the neuroses that are frequently present, and often in intimate relation with this physical state, may be reserved for separate discussion. The chief point in the last-named connection is the difficulty of estimating the time relation of the associated lesions; this problem is often complicated by such anamnestic data as a neurotic family history, or a record of exposure to undue strain at school or elsewhere; in many cases we undoubtedly witness the operation of a vicious circle. Then we have to exclude voluntary semi-starvation on account of dental defects, disease of the

naso faucial lymphatic tract, which regularly leads to this condition in time, if severe, and chronic digestive disturbances, due to improper diet or vicious habits of eating; under the last heading the bolting of food may be due either to a mere bad habit, or again to defective teeth.

Opinions differ widely as to the normal weight of the child; the various tables are derived from radically different material, and we are likely to err in our conclusions, if we disregard racial variations. Three tables are here given, derived from Holt, Bowditch, Porter[1] and Quetelet;[2] they differ so materially as to demand a few words of explanation.

Age, Years	Holt and Bowditch		Porter	Quetelet	
	Height, Inches	Weight, Lbs.	Weight, Lbs.	Height, Inches	Weight, Lbs.
1	29	20	—	27	19
2	32	26	—	30	24
3	35	31	—	33	28
4	38	35	—	36	32
5	41	40	—	39	35
6	44	44	42	42	38
7	46	49	47	44	41
8	48	54	51	46	44
9	50	59	56	48	49
10	52	65	61	50	54
11	54	71	67	52	60
12	56	80	73	54	65
13	58	90	82	56	72
14	60	100	92	58	80

All these tables include clothing, amounting to about five per cent. of the gross weight; the variation according to sex never amounts to three pounds, at these ages, and may be disregarded. The enormous discrepancies among these tables are due to their origin. Bowditch's school children belonged to the gigantic Anglo-Irish

[1] Quoted from Holt. [2] Anthropométrie, 1870.

population at present inhabiting Boston, Porter's children were of the somewhat smaller Anglo-German population of St. Louis, whereas Quetelet's statistics are based on the rather undersized industrial population of Belgium, which is on the verge of the subnormal, if it has not actually crossed that line. According to my personal experience any child falling at all below Quetelet's standard is suffering from malnutrition; even in the rather short-statured foreign population of New York the normal children invariably register a proportionately greater weight than noted in this last table.

The hyperæsthesia to cold is highly characteristic. These children suffer severely from coldness of the extremities, even at moderately low temperatures, and complain of chilly sensations whenever the room temperature falls below 68 degrees. We have already noted that even normal children resist cold much more feebly than adults, but in the cases here mentioned the condition is extreme, and evident on mere palpation to an almost startling degree. Exposure to really cold weather, only a few degrees below the freezing point, always causes a more or less severe congelation of the ears, nose, and extremities. We may mention, in passing, that the outdoor temperature, at which severe freezing of the exposed ears or fingers of fairly normal adults may be expected, is about zero, and even a succession of days near ten degrees fails to produce so great a crop of these accidents as follows one night of say five below zero; in ill-nourished children, however, the critical point is raised considerably, and the milder forms of frostbite may result from temperatures barely below the freezing point. Exposure to winds of the mistral

type of course facilitates this process, and the first victims may appear as early as November, even in the middle latitudes of the United States.

When organic disease and the neuroses can be excluded —the physician cannot be too careful on this point— we generally find one of two causes operating to produce general malnutrition. One is improper feeding, a common and growing vice, particularly in our cities, where cheap confectionery supplies a ready means of undermining the health of young children; in many cases the parents are equally to blame, in giving them such substances as pickles, smoked meats, pastry, and other indigestibles, besides poisoning them with tea, coffee and alcohol. These cases are usually amenable to dietetic treatment, provided that strict supervision be exercised. The second group of ill-nourished children have simply become enervated by overzealous care; they have been kept at home, usually in excessively warm apartments, even in fine weather, because the temperature ranged a trifle low; on their rare outings they have invariably been clothed too warmly in the cooler months, though often made victims of the bare-legs fad in summer. Such children are very apt to fall a prey to respiratory disease at all seasons, and digestive disorders in summer, and the frequent recurrence of these ailments finally leads to a subnormal state in the intervals; these patients are often ill, but seem never to become perfectly well. A subdivision of this second series consists of the victims of a succession of the infectious diseases, who have not had an opportunity to recuperate thoroughly; these children may be briefly described as chronic convalescents.

It is hardly necessary to warn the practitioner that the picture of simple malnutrition, as just outlined, may be a mere mask for latent tuberculosis; even the laity seem to be aware of this relation. It is well to remember that lymphatic enlargement, especially in the cervical region, is suspicious; as is also a tendency to chronic catarrhal affections, whether of the respiratory or gastro-intestinal tract.

From the above outline it is evident that, especially in the group I have designated as chronic convalescents, there is an extensive and profitable field of usefulness in climatotherapy. Fresh air and, except of course in infancy, moderate exercise are the prime requirements; the most suitable climate, therefore, is one that affords an abundance of fine days with a moderate temperature. In winter, a clear sky is, as we have seen, most readily obtained on the coast, where the temperature is also higher and more uniform than inland. Our Atlantic and Pacific Coasts, south of the fortieth parallel, also those of the Mediterranean Sea, to a far less degree those of the Bay of Biscay and the English Channel, supply these requirements in a general way; the two last-named are somewhat cloudy and stormy, forming the transition to the more northerly coasts, which are too rainy on the western, and too cold on the eastern sides of the continents. As to the most appropriate temperature, some regard must be paid to the individual child. Great debility indicates a really warm resort, such as the Florida peninsula, which, though unsuited to invalids in general, may benefit the worst of these cases in mid-winter. Next comes southern California, which is far more generally applicable; the warmest Mediterranean

resorts are but little inferior, unless in exceptionally cold and wet seasons. The Riviera, as well as our own Southeast from Cape Hatteras to St. Augustine, call for but a slight degree of robustness; but Biarritz, the Pyrenees, the greater part of Italy, and most of our southern pine belt, have a somewhat unsteady and cool winter climate, which is not congenial to children that are at all enfeebled. Yeo[1] very properly insists on mild resorts for at least the early stages of convalescence; the Middle Atlantic Coast is therefore too cold and windy from December to March, the resorts of northwestern Europe are too cloudy and stormy, and the southern Alleghanies, as at Asheville, are too liable to sharp cold spells, as well as an excess of rain and snow, to be suitable to this group of cases, in whom anything like hardening is distinctly misplaced in the cold season. This is, however, not the case when the child begins to recover its normal health and strength, but is still in some danger of relapsing if returned home too soon; in this event the localities mentioned are useful as a sort of after-cure.

In summer the little patient is likely to derive benefit from any resort that is neither positively enervating on the one hand, nor very elevated or excessively cool on the other. Determann's[2] recommendation of high elevations in the Alps as a rest cure is intended for adults, and of doubtful advantage to them; Pearce[3], who is quite thoroughly acquainted with our milder Rocky Mountain region, declares these elevations to be quite unsuitable for this purpose; it is safe to say that situations

[1] See bibliography.
[2] Sammlung klin. Vorträge, 1901, No. 308.
[3] New York Medical Journal, Oct. 5, 1901.

above three thousand feet are not good for children suffering from severe malnutrition or retarded convalescence, as there is too much stimulation associated with residence in a highly rarefied atmosphere. Incidentally, the cold nights of the highest mountain resorts are of questionable benefit. We may add that the colder and windier seaside stations are likewise too stimulating for ill-nourished children, especially those of tender age. Ide[1] recently remarked this in connection with the German seaside resorts, especially those on the North Sea, and Robin[2] warns us against excessive exposure to the wind and sun on the north coast of France. Now, neither of these regions is especially sunny, but we find no difficulty in appreciating the force of the stated remarks if we spend a forenoon in the intense heat and glare that prevails on the sands of our Atlantic coast on two summer days out of three; in the afternoon the sun shifts to the west, the reflection from the water and sand is less trying, and there is at least an even chance of a refreshing sea breeze.

Powell[3] advises sea baths for these cases; he reports from Atlantic City, where the water is sufficiently warm on most summer days; unfortunately, the temperature at this resort is too high for the best results in July and August, except for feeble and very young children, for whom surf baths are inadvisable for reasons previously given.

All in all, in treating ill-nourished and convalescent children the best results are likely to be obtained at

[1] Therapeutische Monatshefte, August, 1904.
[2] Archive général de médecine, July 21, 1903.
[3] See bibliography.

such localities as the moderately elevated inland districts of New England, New York, and Central Europe, where prolonged hot spells are uncommon, and the nights are almost always fairly cool. The chief object to be sought, in both summer and winter, is a mild temperature, with moderately abundant sunshine and freedom from excessive dampness, fogs and high winds. It is evident that the greater part of North America between the Alleghanies and the Sierra Nevada is not especially suitable to children suffering from malnutrition or debility during the seasons of extreme cold and heat.

In spring and autumn, particularly the latter, change of climate is of far less importance in the management of these cases, but northward March, often November, and occasionally April, are still somewhat raw and cheerless, entailing a restriction of outdoor life, and requiring a sojourn under milder conditions. Our previous accounts render an extended discussion of this point unnecessary.

Rickets. The rhachitic child presents some differences from the preceding, which call for somewhat different management. Rickets is, indeed, a form of malnutrition, but in this case the morbid process is not so generalized; certain tissues, notably the osseous and muscular systems, suffer severely, whereas the body fat may be developed quite normally or even to excess. The great sensitiveness to cold, that characterizes our first group, is here far from universal, being conspicuous only when the two conditions are combined as happens occasionally, in which event the above climatic suggestions likewise apply.

In this connection, I must not fail to call attention to

a very recent contribution by Hansemann[1] on the etiology of rhachitis, of special interest because of its bearings on our subject. Without ignoring the pernicious influence of artificial feeding, he attributes this affection chiefly to what he aptly calls imperfect domestication; in other words, he regards man as not yet thoroughly adapted to an exclusively indoor life, and deems lack of fresh air in infancy to be the main cause of rickets. To substantiate this theory he adduces certain indisputable ethnological facts, for example, the rarity of rickets in Japan, where the poorer classes guard themselves most imperfectly against the vicissitudes of a fairly severe winter, and calls attention to the fact, most easily established, that the onset of this condition invariably occurs between November and April. The latter circumstance I have taken the pains to verify by careful investigation, and it will not be out of place to add two more bits of evidence. First, I have found that about one-tenth of the exclusively breast-fed infants in my service are rhachitic; inquiry showed that every one of them had been kept at home quite strictly, despite the uncommon mildness of the preceding winter. Secondly, every pediatrician in our northern cities has observed that negro and Italian children are the ones presenting this disease in its most severe forms. It happens that these are the two races most sensitive to cold, who protect themselves most carefully against our northwestern blasts; we note, on the other hand, that the children of Russian parentage, economically perhaps the worst situated of all, present chiefly the milder forms of rickets, because this portion of the community is quite

[1] Berliner klin. Wochenschrift, Feb. 26, 1906.

used to severe temperatures in the winter months. In this connection I might also refer to the contributory influence of the tenement, evident from the remarks on housing made in the preceding chapter, and note the circumstance that, in New York at least, the apartment house, the tenement of the well-to-do, seems to be extending the spread of rhachitis among the economically successful classes of society.

As the last-named condition is apparently beyond remedy, and sure in time to appear in most of our large cities, it behooves the physician all the more to use every climatic measure at his disposal to insure a sufficiency of fresh air to the infants in his charge. It is clear that the prophylactic methods, sketched out in the preceding chapter, apply here most emphatically; in many cases, however, they will come somewhat too late to be merely preventive, and resort to the procedures detailed below will become inevitable. In administering climatic treatment to rhachitic children, we must exercise a certain amount of discrimination, according to whether or not the patient is suffering from general malnutrition as well.

The ordinary victims of rickets, of whom the typical representative is the "infant-food baby," fat and flabby, with a power of resistance far below that indicated by their general appearance, afford a relatively simple problem. These children are not especially intolerant of moderately low temperatures, but are highly sensitive to sudden changes, and do very badly if pampered to any degree. The first requirement naturally is an abundance of fresh air; rhachitic children may be taken out even in fairly cold weather, if bright and not too windy; they may also be subjected to such a mild process of hardening as

is afforded by a daily bath at a temperature of 86 to 88 degrees in the second year, and a few degrees lower afterward. The sleeping apartment should be ventilated as freely as is compatible with safety, and its temperature should be kept below 70 degrees. Overheating and draughts are equally deleterious to these patients, whose respiratory tract readily becomes affected with obstinate catarrhal inflammation that may persist for months.

In selecting a winter climate, we must materially modify the rules laid down before for ill-nourished children and those suffering from retarded convalescence. Such very warm resorts as southern Florida are invariably enervating and injurious in the long run, and therefore absolutely contraindicated. The cool seaside stations, such as those of the Middle Atlantic States and western Europe, are quite sure to prove of great benefit; they involve just about the proper amount of hardening, if employed with certain reasonable precautions, such as the avoidance of fogs and high winds. The children may be given their daily airing even at temperatures below the freezing point, provided sunny and sheltered spots be chosen, and the amount of clothing be adequate. The enclosed solarium is immeasurably inferior in every way; it is almost always too warm and badly ventilated, and should be altogether reserved for very rough and cold weather. Its employment requires far more care than outdoor exposure, on account of the readily developed combination of excessive warmth and draughts; the direct rays of the sun, under glass, are as likely to be irritating as sedative, and their radiant heat is often sufficiently intense to be trying and harmful.

The solarium has gained favor for its supposed phototherapeutic value; a moment's reflection will remind us of the purely empirical status of this idea, for it is not sustained by a single demonstrated case. In opposition to the employment of the solarium it is only necessary to refer to its close resemblance to the gardener's hot-house; the mere comparison is sufficient to condemn it. Hardening may often be irrational, but hot-house treatment is quite indefensible; a more harmful procedure and one more certain to enervate the patient cannot be imagined. The solarium should be used as little as possible, and reserved for special occasions and conditions, never employed in routine fashion; there is little purpose in inveighing against sending patients to the tropics, and then creating a tropical climate for them at home.

Stations subject to violent storms, fogs, high winds, and a mean temperature below the freezing point cannot be recommended for even the fat rhachitic children. They involve too much hardening, and permit too little sojourn in the open air, to be altogether desirable, unless the difficulties and expense of transportation are a factor, in which case even resorts that fall a little below the standard may be infinitely preferable to life in a city tenement.

In summer, these cases invariably do best at cool resorts; the seashore has always been a popular refuge, and tepid sea-water baths add a valuable feature, the surf being, of course, unsuitable to the very young. Rhachitic children of three years or more may, however, be taken into the ocean at low tide at our Middle Atlantic resorts, where the water frequently has a temperature exceeding 70 degrees; it need hardly be said that this

experiment must be made cautiously, on a day when the air is warm and the water also warm and relatively quiet, and not repeated if the child fails to react well. The custom, common in this country, of permitting young children to remain in the water until they become cyanotic with cold, is highly reprehensible, and may entail prolonged invalidism to a delicate or rhachitic child. The extreme time limit for the first dip should be one or two minutes, which may be extended to five minutes under exceptionally favorable circumstances, if the baths seem to benefit the patient.

Unfortunately, the resorts that permit much ocean bathing are often too warm for the best results; even the New Jersey and Long Island coasts are a little enervating, and the general climatic conditions are better on the coasts of New England, the English Channel, and the Baltic. Along the North Sea the summer is perhaps a little raw, as it also is in extreme eastern Maine and the coldest stations of the Maritime Provinces, but fairly hardy rhachitic children do very well in these regions likewise, though the low temperature of the ocean precludes sea bathing. The southwest coast of France has a moderately cool summer, with a few hot days, the water being fairly warm; southern California is very similar on the immediate coast, but too cool on the islands and north of Santa Barbara, too warm even a short distance inland. The cooler stations in the Lake Region are not so very different, but lack the fresh salt air and the opportunities for saline baths; the latter deficiency, at least, seems to be of some moment, and these resorts form a sort of transition to the inland districts of low or moderate elevation.

Rhachitic children do well at the inland localities recommended for the generally ill-nourished, but may often safely be taken to higher altitudes, where the Swiss observers note excellent results. It is, however, a little too cool in the Alps at elevations above 3,000 feet, and the far warmer, yet still bracing, Rocky Mountain stations seem to me to offer very superior summer conditions. Here, too, I would advise some moderation in the matter of altitude, and set the limit pretty strictly at 6,000 feet, for higher up the rarity of the atmosphere and the intense insolation are a little too stimulating.

The climatic management of rhachitic children requires the exercise of considerable discretion: and the combination of rhachitis with malnutrition indicates a compromise treatment, involving a minimum of hardening at the outset, until the weight of the patient reaches the normal, when a more strenuous regimen may be inaugurated, beginning gradually. It is needless to say that individualization and continuous and intelligent medical supervision are necessary to insure the best results; leaving the matter to the parents and their inexpert management is sure to entail a large proportion of failures, whereas marked improvement is almost invariably obtained in sanatoria. It is to be understood, of course, that progress is never rapid; the minimum duration of a climatic cure should be three months, and longer periods, up to a year, show a proportionate benefit.

It is a lamentable fact, here as elsewhere, that our knowledge on this subject is derived almost entirely from foreign sources; winter sanatoria for rhachitic children hardly exist in this country, and retreats for the summer

are adapted to a stay of two or three weeks only, a period too short to benefit these cases materially. The children of our poor population are practically quite neglected in this respect; our resources are largely limited to the families of the well-to-do, among whom rickets is not so very common, and rarely severe.

Anæmia. Most cases of anæmia in young children are merely phases of the two preceding affections; toward puberty, however, we begin to encounter cases of genuine chlorosis, and some of the anæmias of infants show a strong tendency to take on a pernicious form. Morse[1] properly, as I think, considers the types known as splenic anæmia, infantile pseudoleukæmic anæmia (v. Jaksch), and related forms as merely the infantile expression of anæmias that would present less severe symptoms in older subjects. Apart from merely theoretical considerations, however, the gravity of certain anæmias in the very young is evident from the microscopic revelation of such serious changes in the blood elements as cannot very well be refuted. We may therefore confidently take the stand that a routine application of methods suitable to adult anæmias is out of place in the treatment of children.

The effect of high altitudes, and for that matter, more moderate ones, on the hæmatopoietic system, was discussed thoroughly in the introductory chapter. The therapeutic value of this physiological adaptation has been canvassed with some care, and such authorities as Lazarus[2] and von Noorden[3] have convinced themselves

[1] Boston Med. and Surg. Journal, May 28, 1903.
[2] Die Anämie. Nothnagel, spez. Pathol. u. Therapie, vol. 8.
[3] Die Bleichsucht. Ibid.

of the stimulating effect of elevations, up to 6,000 feet, in cases of chlorosis as well as secondary anæmia, claiming that the required increase in erythrocytes and hæmoglobin is fostered by the greater demand of the body for oxygen at the high levels. It will be noted, however, that the former author sets the limit for severe cases at 3,000 feet, and that the latter thinks such high plateaus as the Engadine more valuable as a prophylactic against exacerbations and relapses, than as a cure for advanced cases. Determann[1] distinctly warns against sending sufferers from severe anæmia to the loftier Alpine stations, the same is the opinion of Weber,[2] who, indeed, believes the change of air and scene to be perhaps as potent a curative factor as the mere altitude. It will be as well for the reader to bear in mind that the above observations chiefly relate to young adults who, even when seriously anæmic, are less enfeebled than young children suffering from the extreme degeneration of the blood that we occasionally meet with: the French physicians, as Huchard,[3] are almost unanimous in objecting to altitudes above 3,000 feet in treating anæmic children. Except in individual cases of girls near puberty, we rarely encounter primary anæmia of the chlorotic type in children; nearly every case is secondary to general malnutrition or some wasting acute or chronic disease, entailing other phases of debility; what these patients need, above all, is rest, not stimulation, and certainly not the excessive stimulation inevitable at high elevations.

[1] Loc. cit.
[2] See bibliography.
[3] Bulletin général de thérapeutique, 1897, No. 5.

The same authors, for analogous reasons, plead against sending such children to the rougher and colder type of marine climate, where they are apt to suffer from cold and raw winds, and frequent changes of the weather. On the other hand, they all agree in praising the milder seaside resorts, such as the Riviera in winter, and the west coasts of France in summer; as a matter of fact, they consider the indications in the anæmia of children to be closely similar to those in rickets, namely, mildly stimulating, but not enervating.

I feel that the subject cannot be dismissed quite so summarily; individualization is far more needed than in those cases of simple rickets where the general nutrition is fair to good. The severe anæmias more closely resemble our first group of cases, which present mere emaciation without noteworthy hæmic changes. It is so all-important to conserve the feeble energies of severely anæmic infants and young children, that I would unhesitatingly advocate relatively mild measures. These grave cases are regularly, though not by any means invariably, characterized by the presence of nucleated red blood cells; in the event of such a finding I would begin with a distinctly warm climate, such as south Florida in winter, the Carolina lowlands in spring, and New Jersey in summer; none of them warm enough to enervate rapidly, yet so mild as to spare the general and hæmic metabolism. When the patient has improved so far that the erythrocytes present at the most a moderate poikilocytosis, and the percentage of hæmoglobin has reached about 60, a more strenuous régime may be inaugurated. Naturally, milder anæmias, especially after the third year, may be handled more rigorously from

the very first, in fact, very much like rhachitic cases of the feebler variety; moderately anæmic, fairly robust and older children seem to do better in the mountains than at the seashore. It is, however, evident that altitude, as such, plays a rather unimportant part; the benefit achieved is mostly derived from the life out of doors and the pleasantly low temperature: therefore such regions as the Catskills and White Mountains are in every way preferable to the excessively stimulating conditions in the Rockies, or the April-like weather in the high Alpine valleys.

The wisest plan, in every case, is to treat the patient first, and regard the disease as secondary, which, indeed, it usually is. There is no climatic specific for the anæmias of children, and the general condition is our best guide in almost every case.

The treatment of chlorosis, sometimes seen in girls near puberty, should be along similar lines; the climatic treatment is an admirable adjuvant to the administration of iron, and may be applied very much along the lines just laid down for secondary anæmia. Only the bad cases, with less than 3,500,000 erythrocytes, should be sent to warm regions, and such as show merely a diminution of the hæmoglobin, with hardly any reduction of the cellular elements, may be referred to the mountains, at fairly high elevations, according to the principles before enunciated.

Climatotherapy has also been applied to the treatment of leukæmia, but it is doubtful if any real benefit is derived, especially when we recall the indistinct border line between anæmia and leukæmia in childhood; the question of a correct diagnosis is not always soluble.

Hoessli's[1] claims of success at St. Moritz cannot be accepted as conclusive; he regards the upper Engadine a little too much in the light of a panacea to be quite convincing; we all know that this affection is subject to spells of improvement under any rational regimen, and must regard his view with justifiable skepticism.

SYSTEMIC DISEASES

Under the heading of systemic diseases we are compelled to include a heterogeneous lot of affections which are not purely nutritional or developmental, nor, on the other hand, to be always classed among the infections, though in some cases certainly belonging to the latter group. For our purposes, it will not be necessary to adopt the most recent pathological theories, which did not yet exist when fairly good climatotherapeutic reports were already abundant. Only such of these affections as are amenable to this method of treatment will, of course, be considered here, a reference to all would involve an unnecessary waste of space and time.

Rheumatism and the Rheumatoid Diseases. The treatment of chronic articular and muscular rheumatism may be taken up at this point, for want of a better; the miscellaneous lot of affections called rheumatoid may be appended to rheumatism proper, for the climatic therapeutics of all are practically identical. The subject, as a whole, presents relatively few theoretical difficulties, but our results are rather apt to fall short of our aims, for a variety of reasons, some of which will appear presently; the chief one is a certain inadequacy of all our physical methods as applicable to this group.

[1] Therapéutische Monatshefte, November, 1904.

The main desiderata are warmth and dryness. Since exercise is, from the very nature of these ailments, either impossible or very limited, the patient can remain out of doors only under very favorable meteorological conditions; furthermore, few affections are influenced so unfavorably by chilliness, dampness, and sudden changes, among which a rapid fall of the atmospheric pressure seems to rank first. This last feature is curious and hitherto unexplained, though a matter of almost daily observation. The return or exacerbation of the often excruciating pains begins at the first sign of a change in the weather from fair to bad, while the humidity is still low; it is, in fact, apt to be unusually low on such an occasion. The pains almost always remit as soon as the barometer begins to rise, although the atmosphere may still be saturated with moisture at the time.

In winter we do well to select a subtropical and arid region such as Arizona or Egypt, with southern California as a good second choice. Nearly all the remaining southern stations are too moist to be quite satisfactory, even when sufficiently warm. We have noted the impossibility of compensating for a low temperature by means of exercise; it is therefore quite essential that the afternoon temperature at the resort selected should average between 65 and 75 degrees; a survey of our climatological tables shows that few places combine this requirement with dryness and abundant sunshine, those just mentioned being practically all. It is clear that the management of a sufferer from chronic rheumatism or rheumatoid disease is apt to be unsatisfactory in winter, if the means for a journey of some thousands of miles are not available; it is, indeed, just about as well

to keep the patient in his comfortable home, where good medical attendance is at hand, as to send him to some damp and changeable mountain spa, where the expected benefit from a course of baths is quite sure to be neutralized by adverse weather conditions. Even the mildest of these resorts, such as Hot Springs, Ark., and the Pyrenean stations, have a distinctly third-rate winter climate, most of the others are altogether unsuitable at that season; their usefulness is limited to the period from April or May to October or November. At such southern stations as Hot Springs the summer is intolerably warm and oppressive; most of the other spas are very pleasant in summer, when the combination of baths and climate is likely to benefit many of our patients, but not all. The more intractable rheumatic cases are a sore trial to the patience and ingenuity of the most experienced and conscientious attendant; total or partial failure of climatic, as well as other treatment, is regrettably frequent.

We may here enter on a brief review of the relatively numerous summer resorts with a good or fair climate. The Rocky Mountain region is very dry and fairly warm in the more southerly sections; Glenwood Springs, Col. (5,770 feet) seem fully to deserve their growing reputation, Las Vegas Hot Springs, N. M.(6,770 feet), are also well spoken of, but perhaps a trifle too elevated for some subjects; wind and dust are likely to be the worst features in this section. Banff Hot Springs, Alberta (4,540 feet), has a summer like that of the upper Alps, and is rather cold for young children. The lower inland resorts in the northern United States, Canada, and central Europe are dry enough for our

purposes, provided remoteness from large bodies of water be secured. In this country Mt. Clemens, Mich., in spite of some little exposure to lake breezes, seems to rank highest; the various springs in central New York are perhaps not quite so good. The climate of Hot Springs, Va., is already a little too warm in midsummer, and Hot Springs, N. C., and the resorts of southern Indiana are intolerably hot at that season.

The seaside and the Great Lakes are distinctly to be avoided, and even small lakes, in a thickly forested region like the Adirondack Mountains, are the cause of much dampness at night. Densely wooded tracts are always excessively moist after rainy spells, and deep valleys are subject to night fogs in quiet weather, even if the days have been quite dry. Open plateau sites and mountain slopes, especially such as face south and west, where the drainage of both water and air are good, are far more desirable.

Among inland European resorts our choice is even less limited; almost all those north of the Alps, less than 3,000 feet high, have a fairly good summer climate, and at the various bathing places the medical attendance is far superior to that found at most of our spas. Without referring more than casually to certain practices at such places as Hot Springs, Ark., many of our best resorts are frequented by practitioners of inferior caliber; it is one more instance to be added to the long roll of wasted opportunities on this continent. Meanwhile our invalids spend millions of dollars in Europe to obtain what should be quite as available on our side of the Atlantic.

Summer resorts with afternoon temperatures running

much below 70 degrees are to be avoided, but only the higher Alpine stations are objectionable on this account; the relative inability to take exercise must be taken into consideration. Enervation should be guarded against carefully; it is difficult to avoid, in view of the inactive life of rheumatic patients, and the only sure method is to avoid places and seasons with an average day temperature much above the indifferent point, somewhere near 75 degrees, unless there is compensating coolness at night. In our eastern states few inland stations south of New York and New England fulfill this requirement in July and August; Europe is much better equipped in this regard, as every locality north of the Alps, including even the warmer valleys, is available.

The reader will naturally understand that any such complications as valvular heart disease or chorea will call for a material modification of the above recommendations, and will especially contraindicate the high altitudes in very many cases. For precise details we must refer to the paragraphs that treat of those affections; the relatively simple rules that guide us in the management of uncomplicated rheumatism now give way to a far more involved situation.

The seashore is almost universally deemed unsuitable for rheumatic patients; still a few authorities, among them Yeo, claim to have observed improvement in certain very chronic forms of rheumatism at marine stations, and also look with favor on the employment of warm sea-water baths. With regard to the climate, the exception Yeo refers to is in a measure only apparent, for, as we well know, certain seaside localities, like

southwestern California and some Mediterranean points, are drier in winter than the near-by inland districts: this does not by any means apply to coastal climates everywhere, nor at all seasons. Again, we must remember that there are good and bad seasons at the seashore as elsewhere; even so moist a region as the south shore of Long Island may be fairly dry in exceptional years, when land breezes are unusually frequent. It will, however, be found a safe rule to avoid the coasts, with the possible exception of the two mentioned above: a really oceanic atmosphere is certainly not good for the victims of rheumatism in any form, the sea breeze and fogs being decidedly harmful. Saline baths can be given with nearly equal ease and greater benefit at an inland resort.

The Hæmorrhagic Diseases. Under this heading we are obliged to throw together a series of quite unrelated affections, which, nevertheless, require similar management with regard to climate. Purpura rheumatica calls for the same treatment as the other rheumatic diseases, only chronic cases, of course, coming under consideration here. Scurvy is so amenable to specific treatment that climatotherapy is quite subordinate, and applies only to the secondary anæmia. The curious affection known as paroxysmal hæmoglobinuria, however, is worthy of a few detailed remarks in this connection, since it is, to a certain extent, a condition depending upon climatic influences. To understand this more fully, it will be necessary for us to consider some etiological points.

Attacks of paroxysmal hæmoglobinuria seem to depend upon the combination of two factors, namely, predisposition, and exposure to a low temperature; various

constitutional diseases may come under the former head, notably congenital syphilis; in many cases, however, the predisposing cause is not ascertainable. As to the exciting cause, the evidence is ample; thus, among recent cases, Homberger[1] reports a boy of ten years, who developed an attack from falling into the river in the cold season; Burckhardt[2] showed that cold alone could bring on a spell, but that constriction of a limb increased its severity. Chvostek[3] differs from the preceding in considering the coincidence of cold and traumatism (in the broadest sense) essential, whereas Donath[4] considers a low temperature alone sufficient. Cold, or at least a chill, seems at any rate to be the essential exciting factor. I do not think it advisable, in this connection, to enter on a discussion of the more minute pathology of this curious and somewhat uncommon affection, especially as the authorities have not as yet come to a definite conclusion; the reader is referred to the last three articles for further information.

Sufficient has been said to furnish the climatotherapeutic indication, namely, to send the patient to the mildest and most even climate available, stopping just short of the tropics in winter, and such very warm and moist regions as our southern states in summer. The drier heat of the Mediterranean countries and our Southwest is not very enervating, and may result in benefit. Yeo recommends Madeira, which is equable, and not too enervating in summer; Bermuda is similar in winter,

[1] Zeitschrift für klin. Medizin, vol. 53.
[2] Jahrbuch für Kinderheilkunde, vol. 57.
[3] Ueber das Wesen der paroxysmalen Hämoglobinurie, Leipzig u. Wien, 1894.
[4] Zeitschrift für klin. Medizin, vol. 52.

but the summer is certainly too hot and moist: his recommendation of the West Indies in winter is to be accepted cautiously, but the relatively cool and dry stations, such as the hill country of Jamaica, northwestern Cuba, the uplands of Porto Rico, and the Bahamas, may be tried, at least for one season. Key West, outside of the tropics, but with practically the winter climate of Havana and Nassau, has a particularly even temperature, except when a norther springs up, and the rainfall is very small from December to March. In summer, the lowlands of the Middle Atlantic States, excepting the hottest places, such as the lower Delaware Valley, also the resorts of the southern Alleghanies, afford a good climate: the best stations of California, away from the immediate coast, but not too far inland, are excellent for this purpose, Los Angeles and its vicinity may safely be recommended. In Europe, I would select the southern slope of the Alps, including the Lake of Geneva and southern Tyrol, but avoiding such very low-lying stations as Riva, which has an altitude of only 300 feet, and a July temperature like that of central New Jersey and the lower river valleys of Pennsylvania. Among foreign winter resorts, Madeira, as stated, and upper Egypt are by far the best; in this country Florida leads, southern California comes next, all the others are inferior.

Amyloidosis. Amyloid degeneration of the various cellular organs usually follows chronic suppurative processes in children, rarely congenital syphilis (Osler), in contradistinction to its frequent sequence to acquired lues, and is a subject for climatic treatment in an exquisite degree. The prognosis of amyloidosis is not

quite so unfavorable in the young, as in older subjects, and a consistent attempt with climatotherapy, the only procedure of any great value, is always well worth the making.

The most important, and the majority, of these cases follow in the train of a chronic tubercular affection, usually of the bones; the chief interest lying in the circumstance that the detection of even an early stage of this serious degenerative process calls for an immediate abandonment of the hardening régime that is usually so essential a feature in the management of the primary disease. The victim of amyloidosis urgently demands a warm and dry climate; the brisk sea and mountain air that so greatly benefits the uncomplicated tubercular osteitis, becomes exceedingly harmful when this complication has developed, and the patient now requires prompt transfer to a milder climate, though that may have a less favorable action on the underlying process.

The organs in which amyloidosis is regularly first detected, and in which it is of the most serious consequence for the organism as a whole, are the kidneys; the clinical picture of amyloidosis, in fact, closely resembles that of a chronic diffuse nephritis in its more dangerous stages. This happens because amyloidosis is rarely detected before it is well advanced, its symptomatology being largely masked by the underlying condition and the albuminuria which is so common in chronic febrile affections like tuberculosis; a previously existent nephritis, of mild degree and not seriously regarded, naturally aids in masking the earlier stages of amyloid degeneration.

The treatment of this affection, as would be expected,

approximates closely to that of the severer forms of chronic Bright's disease; progress is therefore slow, so that the curative process, if at all attainable, is likely to extend over a series of months or even years. This may not appear very important, inasmuch as the primary affection is also excessively chronic, but we must bear in mind that only very few climates are really beneficial to these subjects, and that the prognosis is dubious at best; thus enormous sacrifices may be imposed on the patient's family, and turn out to be fruitless after all. The only method that really commends itself is a stay at an appropriately situated sanatorium for a year or more, an expedient within the reach of only the very well-to-do in this country, where sanatoria for poor children are almost non-existent. "They order this matter better in France."

For the various climates suitable to the treatment of amyloid disease the reader is referred to the paragraphs on chronic nephritis. The recommendations there worked out in detail apply here even more forcibly, the only very important differences being in respect to the duration of treatment and, unfortunately, too often in the prognosis.

Congenital Syphilis. Severe cases of hereditary syphilis may derive great benefit from a change of climate; the guides we should follow are symptomatic. Thus, the management of the individual case will vary according to whether a severe anæmia of the von Jaksch type, or intractable gastro-intestinal symptoms, or a state of lymphatism, or visceral degeneration dominates the picture. While this disease, in the adult, is conspicuously amenable to specific medication, this is true to a

far less degree in children of a tender age. Babies, in particular, often thrive but poorly in spite of most intelligent mercurialization; even if they gain some in weight and become free from all demonstrable lesions, they often remain subnormal in health and subject to a recurrence of symptoms. In addition, some of the worst cases are not very tolerant of the specific drugs; anæmia and other forms of malnutrition are apt to develop and menace the patient's life very seriously.

There is therefore a considerable proportion of syphilitic infants and children who require tonic treatment quite as much as mercury and the iodides, and one of our best tonic measures is removal to a temperate climate. The best temperature for the winter is as low as is consistent with a life out of doors, higher, therefore, in the very feeble than in those in a state of fair nutrition; in this matter the physician may be called upon to employ no little judgment. In the warmer months the seaside has long been regarded as the sovereign remedy, including warm salt baths for infants and cooler ones for older and more robust children. For the latter the milder mountain resorts have hardly received their due meed of attention, and I think they merit a more extended trial than they have had hitherto. Older children, in whom moderate general malnutrition and anæmia are practically all the lesions that concern us, often require considerable toning up; I would not hesitate to send them to the more bracing resorts of the Alps or Rocky Mountains, or the colder hill stations of our northeastern states.

Malaria. Although so exquisitely a climatic disease, malaria is only indirectly amenable to treatment by a

change of air. In the direction of prophylaxis, the selection of a suitable climate is of course paramount, but in an established case departure to a non-malarious region has more effect on the secondary manifestations, such as the anæmia, than on the protozoa in the blood and viscera, which must be combated with quinine and arsenic in the usual way. So slight is the direct curative effect of a cool climate on the disease itself, that the mere trip to such a region may bring on an attack where the affection has remained latent, the exciting cause probably being a slight chilling on a cool night; it is well known that paroxysms are apt to be provoked by exposure to cold or wet.

Nevertheless, our first move in the management of a case of malarial fever or masked malaria, aside from the specific medication, must be removal to an immune region, on this continent any locality with an average July temperature below 66 degrees; in this way, at any rate, we guard the patient against reinfection. As to eradication of the disease, we can hold out no promise as the result of such a journey; the total destruction of the parasite must, apparently, be effected by drugs in most instances; the action of climate is merely auxiliary, but I doubt if it can be considered specific in any sense, so far as a once infected individual is concerned. The spread of the disease to uninfected individuals is, of course, obviated by recourse to an antimalarial climate.

Malarial cachexia is also a fit subject for medical climatology, but the indications here are quite different, being in general those discussed under the title of nutritional diseases. In no case, however, may we select a

region not absolutely free from the malarial parasite; some of the very mild winter climates, notably that of the Florida peninsula, that might possibly be chosen for extremely debilitated cases, with marked hepatic and splenic enlargement, are therefore to be rejected. In mild seasons, there is some malaria in the region named throughout the winter, for, as previously noted, killing frost visits southern Florida only about every third year, and then for only a day or two at a time. Otherwise, the principles laid down for malnutrition and severe anæmia hold good; the precise application of climatotherapy to the individual depends on the symptomatic indication.

CHAPTER VI

VISCERAL DISEASES

The climatic treatment of disease in any single organ or group of organs usually involves a careful balancing of the relative importance of the local lesion on the one hand, and the patient's general condition on the other; only in exceptional cases are we called upon to direct our treatment to any one symptom. This is, of course, inevitable, for climatotherapy, as already stated, is so general a method, that its strictly local application is impossible, and its effect on the body as a whole must always be kept in view. The importance of maintaining this attitude is sufficiently great to warrant its repetition here, even at the risk of appearing wearisome.

There are, however, a few exceptions to this broad rule, where certain climatic affections are concerned; we may add that these constitute about all the instances in which acute organic ailments come within our scope. In visceral disease, in general, the domain of climatotherapy is almost limited to chronic affections, nearly all of which are, however, included; it may be said, without exaggeration, that there are few of them that cannot be ameliorated by an appropriate climate; in a considerable number all other therapeutic procedures become of minor consequence. It is, for this reason, not remarkable that the present chapter, in spite of extreme and possibly excessive condensation, is rather

long, merely because of the very wide range of subjects presented for discussion.

DISEASES OF THE UROPOIETIC SYSTEM

Albuminuria. The occurrence of albuminuria without any demonstrable renal lesion is now quite generally accepted; it is variously designated cyclic, orthostatic, or adolescent, all of which terms are more or less descriptive of the circumstances under which it is encountered. In addition, many persons develop this disquieting symptom after excessive muscular exercise or very cold baths. As cold bathing plays an important rôle in the hardening régime, as well as in general physical therapeutics, a few words on this phase of the subject will not be amiss. Rem-Picci[1] has made a series of investigations, on adults, it is true, which show that albuminuria may follow an immersion of fifteen minutes in water at 60–68 degrees, and a three-minute dip at 54–56. In robust persons, who did not excrete albumen after warmer baths, the albuminuria was transitory, disappearing within twenty-four hours; we cannot help thinking, however, that frequent repetition of such baths may sometimes result in a permanent condition of the cyclic or orthostatic type, if not true renal disease. The same apprehension exists in cases where albuminuria appears after violent exercise, as indulged in by athletes; here also we may justly dread the eventual development of a chronic disorder.

At this point it can do no harm to remind the reader of the series of animal experiments detailed in a previous chapter, in which chilling the surface of the body plays a leading part in causing albuminuria, and to recall the

[1] Il policlinico, 1901, No. 53.

relatively feeble resistance of children to adverse influences of this kind.

If we omit such albuminurias as are altogether transitory from present consideration, I feel that we are bound to agree with Senator[1] that we cannot exercise too much caution in regarding the remaining cases as compatible with absolutely normal renal tissues. Surely, it is not a pure coincidence that cyclic or orthostatic albuminuria is particularly frequent in the train of scarlatina and diphtheria, and no experienced practitioner will be misled by the fact that the infectious disease may have preceded the first positive demonstration of albumen by months or even years. It is sufficient for us to remember that chronic nephritis may develop most insidiously, escape observation during its early stages, and finally be revealed quite casually in the routine urinalysis which the physician is in duty bound to make periodically for every one of his patients. Continued and precise investigation will show that these patients quite regularly excrete a trace of albumen during the waking hours, especially if muscular exercise is freely indulged in, though the urine passed on rising is normal. If such a patient presents, in addition, what the experienced practitioner learns to recognize as the nephritic habitus, the case should be regarded as highly suspicious with respect to the presence of a true organic lesion. In this connection it is both interesting and important to note the obstinate persistence of these traces of albumen; they are pretty certain to continue for months, and extension of this abnormality over a still longer period makes the eventual diagnosis of true chronic nephritis almost unavoidable.

[1] Nothnagel, specielle Pathologie u. Therapie, vol. 19, part 1.

In view of the above array of facts, the treatment of cyclic or orthostatic albuminuria becomes identified with that of chronic nephritis. We may indeed go further, and insist on the relatively greater importance of properly managing the former; for, if it is desirable to reduce so dangerous a lesion as nephritis to comparative innocuousness, even when there is no prospect of a real cure, it is infinitely more necessary to wage an active campaign against what may be its early stages when the prognosis is very much more hopeful. As to the precise methods, however, we may content ourselves with those to be recommended for nephritis as fully established; the differences in managing albuminuria alone are quite trivial, and will be touched upon below.

Nephritis. Acute and subacute nephritis are emphatically subjects for home treatment, but the chronic forms of Bright's disease form an attractive and profitable field for climatotherapy; there are indeed few diseases that are so likely to undergo improvement upon removal from a severe to a more genial climate. The main indication is already clear from our discussion of albuminuria; it consists in the avoidance of cold, especially when combined with dampness. The choice of a warm and dry climate is not, however, limited to the above-outlined aims, which are in a measure prophylactic; it is also intended to favor a species of physiological readjustment, which has always invited the attention of therapists.

In treating nephritis, it has been for centuries a recognized principle to spare the diseased organs as much as possible. This indication is met most readily by

throwing as much of their work as possible upon those excretory channels that can vicariously assume a portion of their duties. Although the kidneys, as is now generally accepted, do not constitute mere filters, yet, in a certain broad sense, the filtration of the blood is their chief function; their contribution to metabolism is less essential, though we must admit that certain excreta are disposed of only with difficulty through the several vicarious agencies. Apart from the utilization of the intestinal tract, which does not concern us here, our main reliance is on the glandular apparatus of the skin, whose activity is accelerated by external warmth, and almost in abeyance in a cold medium. We therefore appropriately employ warm clothing, hot-air and hot-water baths, besides promoting diaphoresis in every other way. Warm weather is the mildest and most continuous diaphoretic known; its dosage can be gauged accurately by observing the thermometer and regulating exercise, and we can safely push this treatment to the verge of enervation; we must, however, take pains to avoid a high percentage of atmospheric humidity, as this in turn tends to check perspiration.

Thus, in prescribing a warm and dry climate in the treatment of chronic nephritis, we meet the sparing indication exceptionally well; we may now pass on to details. In regard to the choice of a first-class winter climate for patients suffering from this disease, especially for such subjects as also, for any reason, require abstention from muscular exercise, most of the authorities do not hesitate to recommend what Leonard Williams calls "relaxing" climates, meaning thereby such resorts as Madeira, southern Florida, and the Bermudas, which

are decidedly warm and rather moist during the winter months. Moisture is, however, always objectionable, and such less warm, but dry, regions as Egypt, southern Arizona, and the Mexican plateau are, in my opinion, decidedly preferable. The southwest of California also takes a deservedly high rank; Algiers, Malaga and Sicily are nearly as good. With regard to California, I would refer especially to a recent communication by Edwards,[1] in which a modest claim for curing only cyclic and orthostatic albuminuria is made, but from which we are bound to conclude that cases of true chronic nephritis, following the infectious diseases, are at least brought to a standstill, with the total disappearance of albumen from the urine. The warmer portions of our South Atlantic States, as well as the Riviera, must be regarded as somewhat inferior; both of these sections occasionally have very bad weather in winter, and are more suitable to the uncertain transitional period of early spring.

Périer[2] does not hesitate at a general condemnation of the French coasts in the treatment of nephritis and albuminuria; the material collected by the French observers is sufficiently ample to justify any standpoint they may take on resorts so familiar to them; in any event, a careful climatic survey of France seems to limit the scope of its shores, in nephritis, to the thirty-mile strip on the Riviera, from Cannes to the Italian frontier. It therefore goes, almost without saying, that even our pleasantest northern resorts, as well as the most favored stations of northwestern Europe, are not to be considered at all in treating such patients during the cold season.

[1] Archives of Pediatrics, June, 1905.
[2] Annales de médecine et de chirurgie infantiles, 1901, p. 479.

In the management of this group, it is also very important not to permit too early a return home; as a valuable guide I would recommend the map, previously given, which shows the progress northward of settled spring weather. As the farther South grows too warm, an intermediate station may be chosen, to bridge over the period of transition; there are many excellent semi-southern inland stations on the southern slope of the Alps and in our southern Alleghanies. This precaution, reversed, is far less important in autumn in this country, for reasons before stated; we can afford to wait until really cool weather sets in, and then transport the patient to the far South at once.

In summer, the whole matter is very much simpler. The best results are obtained at fairly warm localities, avoiding intense heat and a humidity in excess of 75 per cent. The best mean temperature is between 68 and 72 degrees, depending largely on the age of the patient and his capacity for exercise. Speaking generally, inland resorts are best, for the fogs and damp winds of all but the warmest seaside stations are objectionable. On the other hand, places not far from the coast, but free from the aforesaid disagreeable features, with the temperature still somewhat equalized by oceanic influences, may safely be recommended. Southern New England and western Europe afford many such resorts, neither too cool nor too warm, with about the right proportion of humidity and a moderate rainfall. The very dry climates, such as that of the Southwest, may be quite as beneficial, but there the dustiness of the summer is an objectionable element. Most of the Californian resorts are either too hot or too cold and damp at this

season; in general the northeastern states will be found better from June to September or October.

As to high altitudes, the consensus of opinion is adverse. Edel[1] goes into the subject at some length, and attributes the unfavorable results at great elevations to an increase of the blood pressure. It is true that the blood pressure is already excessively high in advanced cases of chronic nephritis, but this is a more serious matter in adults, who are apt to be suffering from a concomitant arteriosclerosis, and therefore dare not run the risk of a further strain on the arteries than in children, whose renal affection is likely to be comparatively recent. It is worth while to note that this same author makes a counter-recommendation, in that he deems the moderately high Alpine resorts well suited to the treatment of mere cyclic albuminuria. Now, we have seen that it is quite impracticable as well as inexpedient to draw a line between simple albuminuria and the more insidious forms of chronic nephritis; when, therefore, Edel says that the increase of arterial pressure at high altitudes actually benefits the former, he seems to place us in a sort of dilemma. The matter is, however, not so confused as appears at first thought, and quite susceptible of explanation; the trouble lies, once more, in undue reference to children of the observations made on adults, often beyond the prime of life. Edel's standpoint is quite acceptable, if correctly interpreted; it is unquestionably true that recent cases of nephritis, in which secondary fibrosis has not yet set in to any noteworthy extent, possibly also the early stages of the large white kidney, and naturally mere albuminuria without

[1] Münchener medizinische Wochenschrift, May 10, 1904.

demonstrable renal lesions, may do very well at moderate elevations.

The wisest procedure consists in exercising a considerable amount of conservatism in regard to sending children with Bright's disease or albuminuria to mountain resorts; in any event, it is well to limit the altitude to 3,000 feet, save where the patient's former residence has thoroughly habituated him to a low atmospheric pressure. Therefore, children native to the middle Rocky Mountain region, who give evidence of one of these affections, may frequently be permitted to remain at home during the summer months, the more so as the temperature and humidity conditions there are of the very best. In winter, however, it is undeniable that a milder climate is far more beneficial.

With the exception just mentioned, the higher elevations are, in almost every case, too cold for nephritic patients, and usually also too damp; in the mountains of central Europe I should certainly set the limit at 2,000 feet, save in carefully selected cases. The same limit may be applied quite generally in the northern Alleghanies; on the other hand, Edel's recommendation for the mild types ought to obtain the benefit of a trial in the higher southern Alleghanies; Asheville and Hot Springs, Va., are more than sufficiently warm, and I would not hesitate to make the suggested experiment in the presence of mere albuminuria.

It is sufficient, in this connection, to repeat that the genuine contracting kidney is a curiosity in childhood, and that the secondary contracting kidney has rarely had time to develop; general arteriosclerosis is likewise very uncommon in early life, though cases have been

reported in connection with congenital syphilis. As a rule, the main objections to moderately high altitudes fall away, when we consider the young subject exclusively.

The practitioner, as already stated, cannot exercise too much caution with regard to the abandonment of the very mild regions in favor of such as are more bracing, or the home climate. No change of consequence should be ventured upon until it is quite settled that the disease has reached a standstill; when that has been satisfactorily ascertained, the cooler climates have a field of usefulness in the way of a renal test, to determine the probability of a more or less permanent cure or amelioration, before the patient returns to his former life. The worst cases seem to demand permanent residence in a mild climate, unless we wish to invite an early relapse.

It should hardly be necessary to add that, even when very mild maritime resorts have been selected, sea baths are contraindicated in renal and albuminuric cases. The ocean, in summer, rarely has a temperature much exceeding 75 degrees, even in subtropical latitudes, and in winter, at the warmest stations mentioned, it is usually very much colder. On the other hand, the indoor administration of sea-water baths at 92 to 95 degrees is of great benefit, for sea water, containing four or five times the physiological (isotonic) proportion of salts, powerfully stimulates cutaneous osmosis, promoting the excretory functions of the skin in an effective, yet not excessive degree.

The "Surgical" Kidney. The suppurative renal affections, so far as they do not fall within the scope of the operative surgeon, are quite certain to derive some

benefit from the somewhat relaxing treatment just recommended for nephritis and albuminuria. Chronic pyelitis and pyelonephritis are far more apt to run a favorable course in a decidedly warm climate than elsewhere, on the same principle of sparing the renal tissues as far as possible. Uncomplicated renal lithiasis is not, to any extent, a subject for climatotherapy; but the combination of calculi and suppurative nephritis is quite frequent, at least clinically, and here we must follow the main indication, offered by the inflammatory process, so far as physical therapeutics are concerned. Even more than in ordinary nephritis is time an element in treatment, and the attendants of the child must be prepared for a stay in warmer latitudes, extending over the entire cool season, or it may be, a year or more, rapid cures being entirely beyond the realm of possibility.

In many of these cases there is manifest advantage in combining treatment with one of the alkaline or earthy mineral waters with suitable measures of climatotherapy. Vichy in France, and Neuenahr and Wildungen in Germany, to select a few examples, are admirably adapted to this plan. It is doubtful if any American springs are equally good, at any rate there has been no intelligent study made in this direction. Unfortunately, this combined treatment, at the European spas, is feasible only during the warmer months, for these climates are all far too cold and moist from October to April; as a matter of fact, visitors are not even expected at these resorts during the cold season.

Hirsch[1] claims that the climatic theory of renal lithiasis, which is the commonest underlying cause of

[1] See bibliography.

suppurative disease of the renal pelvis, is not founded on fact; this affection is indeed exceedingly common in lower Egypt and in Italy. Notwithstanding, it remains true that practically all these cases do better in warm and dry climates than elsewhere, and that they are apt to fare rather poorly in marine or inclement localities. The indication of warmth is far less imperative in the cases of simple renal lithiasis than in those in which a suppurative process has supervened; in the latter it is the main point to be considered in treatment.

The prudent practitioner will naturally be very reserved in giving a prognosis for these cases, especially with regard to the element of time. Nevertheless, although the prolonged course of these affections makes the benefit of climatotherapy somewhat conjectural, we always seem to feel that these patients would not have got on so well at home.

In contradistinction to the suppurative affections of the kidney, mere hydronephrosis rarely calls for climatic treatment. The advantage of a change of air, apart from its general beneficent influence, is very doubtful, and, in non-operative cases, the choice of residence is not very material. Operated cases, of course, recover strength more rapidly in a favorable climate, the same as other convalescents.

Diseases of the Bladder. Climatotherapy plays rather a minor rôle in vesical diseases, but removal to a milder climate will often be highly beneficial in cases of chronic cystitis. Some care is, however, advisable in adopting this plan of treatment, in view of the tendency to a higher concentration of the urine in warm weather, caused by the increased elimination of water through the skin.

When the urine attains a high specific gravity, it is apt to increase the vesical irritation, and thus neutralize some of the improvement to be expected in a mild climate. It is therefore wise to exercise some discretion, and avoid localities where the day temperature rises much above 70 degrees; in winter, merely temperate regions, such as California and the Riviera, as well as the South Atlantic States, are best in every way; in summer, we should select the moderately cool and moist inland resorts, avoiding the high and cold mountain stations, as well as arid regions.

The observations on mineral springs, made a few pages before, apply here with special force, for the alkaline waters are of the highest value in these affections. It is a curious and inexplicable fact, that equally good results are never obtained from the same waters when taken at a distance from their source, though they are of some value even then.

The treatment of enuresis belongs, more appropriately, to the section on nervous diseases, but, apart from the undeniable neurotic element, vesical irritation is often an important factor, especially in such forms as are diurnal and associated with pollakiuria; the climatic indication here is similar to that of manifest cystitis. In the purely nocturnal type of enuresis the neurotic element undoubtedly predominates, but these cases may also be benefited by a similar course of treatment; this affection can, however, be discussed to better advantage under the heading of nervous irritability, of which it is a rather typical manifestation; anatomical lesions of the urinary tract are usually quite absent in purely nocturnal enuresis.

DISEASES OF THE DIGESTIVE SYSTEM

The interrelation between diseases of the alimentary tract and climatic conditions obtained full consideration in the first and fourth chapters, where the prophylactic value of climatotherapy in this group of affections was made evident. Owing to local causes, the study of this branch of our subject has centered largely in certain American cities; hot summers and sanitary neglect, either of which might have been tolerated by itself, in combination had become irresistibly fatal to infants and very young children, and the amelioration of hygienic deficiencies, by means of the inspection of milk and the improvement of the tenements, was taken in hand with some vigor. But, as previously noted, progress in this direction has certain well-defined limits, set by unfavorable climatic and housing conditions which, of course, cannot be obviated; within these limits the prophylactic measures just mentioned are attended with reasonably good results. When, however, gastro-intestinal disease has actually set in despite all precautions, removal to a better climate is our main resource.

For our purposes, the topic of digestive disturbances centers on the presence of diarrhœa, and the best manner of proceeding with our subject is to divide it into the two sections of acute and chronic diarrhœal diseases. The anatomical picture, be it a mere indigestion, a bacterial intoxication, or an entero-colitis, is relatively unimportant so far as climatotherapy is concerned, and chiefly affects the duration of treatment and the prognosis, the methods being the same for all.

Acute Diarrhœal Diseases. Since a high atmospheric temperature and humidity are the prime factors in producing acute diarrhœal disease, the obvious indication is removal to a locality that is cooler or drier, preferably both. In the case of the children of the well-to-do, this is a comparatively easy matter, and a few days at a cool seaside or mountain resort will almost invariably work wonders. The distance traveled need not always be great, and with badly exhausted children, who do not bear railway transportation well, this is a matter of some little consequence. Even in the suburbs of cities, the night temperature is three to four degrees lower in summer, and in the actual country districts there is a difference of seven degrees and more at night in clear weather, though the day temperature may not be any lower. Thus the daily range in New York City, in July and August, is between 66 and 81 degrees, whereas among the low hills of Westchester County it ranges from 59 to 81. At the seashore the nights are not so much cooler than in town, but the sea breeze cuts down the afternoon temperature, so that the south coast of Long Island has a daily range from 64 to 76 degrees. In the former region the humidity is a little lower than in the city, in the latter a little higher; the chief gain is in a lower temperature and purer air. It is, of course, better, whenever practicable, to remove the infant to such cool and bracing climates as the northeastern coast or mountains, or the cooler stations in the Lake Region; in the presence of a severe attack, however, a long journey may be inadvisable, and in the case of the large cities near the seaboard and lakes, it is not generally necessary.

The children of the poor cannot, for pecuniary reasons,

be transported to distant resorts, and must avail themselves of the best near-by situations. In our seaboard towns the problem is relatively simple, and children may be conveyed to the breeze-swept ocean front, a thousand or more at a time, in boats or barges, the trip itself being something of a remedial measure. Transportation by rail, on the other hand, is rather injurious, and should be avoided whenever a journey by water is feasible.

A very easy, but unfortunately rather ineffectual, plan of treatment is by means of the day trip in the so-called floating hospitals. These institutions, in the form of great barges, under the supervision of a competent physician who is aided by a staff of nurses, leave the city in the early morning, call at convenient landing places, cruise about the quiet waters of the harbor, and return toward sunset. Great as is the relief afforded by the floating hospitals, it is but palliative, owing to the necessity of returning the sick infant to the fetid tenement for the night; it is doubtful if the trip permanently benefits any but the mildest cases and older children, and there is every reason to believe that the chief value of the floating hospital is in the good food, medical attendance, and educational influence afforded on board.

The imperfections of the floating hospital may be largely remedied by operating it in connection with a seaside sanatorium. All the serious gastro-intestinal cases should be referred from the former to the latter; the floating hospital thus forms a capital channel for the selection of patients for the sanatorium, which alone can effect a real cure in all but the milder dyspeptic cases. Our seaside sanatoria are all deficient in allowing the little patients too short a stay, two weeks being usually

the limit; it must be admitted, in extenuation, that these institutions are not entirely free agents, owing to popular ignorance and insufficient accommodations. We are evidently still in a stage of early development in regard to these matters, and more education is needed by both the philanthropist and his beneficiaries.

In inland cities, such as Cincinnati or St. Louis, the problem of caring for the children of the poor, during the intensely hot summer that prevails in those latitudes, presents the gravest difficulties. The seashore or lake front is hundreds of miles away, and the level character of the surrounding country renders a reasonably cool refuge in the vicinity absolutely unobtainable. In the unusually hot July of 1901, for example, not a single locality in the state of Missouri was as cool as the lowlands of Porto Rico and Cuba, and the other central states were but little better. At the same time the average temperature on the eastern Maine coast, in the higher northern Alleghanies, and in northern Michigan, ranged from 62 to 68 degrees, though that month was one of the hottest on record in these localities also. These cool regions are inaccessible to the children in the cities mentioned, except in the case of very well-to-do families, who rarely spend the summer in town in any event.

The credit for developing and studying the subject of floating hospitals and seaside sanatoria belongs, in the first instance, entirely to private philanthropy in Boston, whence these institutions have spread to New York and Chicago, but to few other localities. The municipalities, with all their wealth and resources, have done little or nothing, as is usual in this country. When we analyze the subject carefully, we see that even such private

activity as has been manifested in this direction is almost entirely due to the fact that the cities mentioned have been relatively favored by nature, as their situation on the water front affords unusually good opportunities for communal work of the kind described. This remissness of the municipalities, to which there are hardly any exceptions—New York is only to-day awakening[1] to the situation, now that nearly all of her magnificent water front has been occupied for other purposes—should not astonish anybody who is familiar with our municipal administrations and their ways. It is true that we have done better than the Europeans in a few details, but our climate renders our necessities infinitely greater.

Chronic Diarrhœal Diseases. Next to the immediate peril to life, the chief danger involved in the acute diarrhœal diseases of infants and young children is the eventual development of a chronic entero-colitis. This is peculiarly apt to follow an acute intestinal inflammation, but is also a frequent result of a neglected or inadequately treated indigestion. It appears more than probable that the treatment of acute diarrhœal affections by a mere day's outing is often responsible for this untoward outcome. The baby shows some improvement after its trip, but is not quite well; the same treatment is repeated for days with only partial success; the infant in the mean time sleeping in a stuffy tenement and possibly being improperly fed besides. It is evident that a case of this sort would have fared better under sanatorium treatment in the first instance, prolonged until an actual cure had been effected, and maintained for some days thereafter.

[1] Boston awoke a few years ago.

For chronic diarrhœa in children, as it occurs during the summer months, a change to a cooler climate is absolutely imperative, and we may say at once, the cooler the better, barring such as are absolutely raw, for example, exposed situations from San Francisco northward; on the Atlantic coast there is almost no place that is too cool for these cases, and Maine and Nova Scotia are probably best of all. In a line with these might be set the higher elevations from the Catskill Mountains northeastward, the hill country from Pennsylvania southward being hardly cool enough for the best results, as the day temperatures are apt to be rather high. Long Island and New Jersey are likewise a little too warm and sultry to achieve the best results in chronic diarrhœal disease: the cooler portions of the Lake Region, as for instance northern Michigan, are decidedly better, but still not so bracing as our northeast coast. The shores of northern and western Europe offer many excellent situations, but the ocean voyage is an impediment to be regarded seriously in digestive disorders; in selected cases, especially in older children, the resorts along the English Channel, North Sea, and Baltic may be tried, and the mountains of central Europe offer no end of highly salubrious stations, with the additional important consideration of better food than is dealt out by the average American hotel proprietor. It must not be forgotten, in this connection, that cases of chronic diarrhœa no longer tolerate the semi-starvation that is often a valuable curative agent in acute indigestion. On the contrary, the food must be rather ample, and, furthermore, of a kind and preparation to spare the diseased intestine as much as possible. Persons familiar

with the dietary at many American summer hotels, even some of the higher-priced grade, will appreciate the force of these remarks, and the difficulties likely to be encountered.

For the children of the poor, climatic treatment is even more essential, but the question of expense is, at least in this country, an obstacle to the selection of a truly first-class climate, so far as most cities are concerned; it usually becomes necessary to choose the best near-by locality for a children's sanatorium. While it is incontestable that some very fair work has been done in this field, the greater part still awaits realization; at present the sojourn of the patients in the mountains or at the seaside is generally limited to a few weeks, a period altogether too short to effect a cure in a large proportion of cases, the more so as the children are sent back to the noisome atmosphere of the city before the hot season is over. Better provision should be made for keeping obstinate diarrhœal cases, especially such as show a general impairment of health, in the country at least until the end of August in the North and some weeks later in the South. This can, unfortunately, be effected only after an increase of the present facilities, which suffice only for the more urgently sick children. We must, moreover, not forget that a little more education of the public is also demanded; too many parents are apt to desire the return home of their children, long before anything like a complete cure has been effected.

Children above the age of three or four years are not benefited so much as infants by a stay at our moderately warm seaside resorts, and an earnest endeavor should be made to send them to a truly bracing summer climate,

preferably at some little elevation. The older the child, the more persistent a type of intestinal catarrh is apt to be before us, since a more serious, long-continued, or often-repeated acute disturbance was necessary to set up a chronic condition. We cannot, therefore, go far astray in choosing a more energetic form of climatotherapy in older children, and insisting on its prolonged continuance, preferably until cool weather has come to town for the season, even if the patients appear thoroughly well weeks before that time. All our eastern highlands are suitable to these cases; the far northeastern coast resorts are not quite so good, being too damp, and sometimes rather raw, but they often prove quite adequate. For children of the school age, the July isothermal of 66 degrees represents the southern limit, which it is best not to overstep, if we desire to achieve really brilliant results. The Rocky Mountain resorts are rather warmer, but the extreme dryness acts as a compensatory factor, so that a few extra degrees of warmth may be disregarded. In central Europe, nearly all the popular resorts suit our purpose, as is also true of the Atlantic coast from France northward and eastward to the Baltic Sea.

It is useful and important to remember that a prolonged stay, beyond what is actually necessary to achieve an apparent cure, will in no case be superfluous; as observed before, children of the school age are in any event a troublesome proposition under our modern conditions, and a little surplus of vitality can only be advantageous in the long run.

Non-diarrhœal Dyspepsia. Digestive disorders that are not attended with diarrhœa do not usually call for climatic treatment. An exception should, however, be

made in all cases of infantile dyspepsia, even if diarrhœa be absent; though this statement seems almost unnecessary, its important therapeutic suggestion is often disregarded, with disastrous results. The practitioner who sends all infants and young children that manifest any sort of severe digestive disturbance during the warm season to a cool resort in the country will have the smallest proportion of debilitated subjects on his hands in the autumn. It is a grave error to await the appearance of diarrhœa, before resorting to a change of climate; its success is so certain, its omission so fraught with danger, that the only safe procedure is to prescribe it promptly in every case, losing no time with temporizing or mere internal medication. Material considerations should not be allowed to stand in the way of the one sovereign remedy, and fortunately it is usually available in some of our cities for rich and poor alike, although perhaps inadequately so far as the latter are concerned.

RESPIRATORY DISEASES

We have already remarked that the diseases of the respiratory system, so far as seasonal distribution goes, present a sort of complement to the affections of the digestive tract; the association of climate and disease is, however, far less intimate in the group here under discussion. Another difference lies in the circumstance that acute respiratory diseases are not in any way subjects for climatotherapy, but require home treatment alone. The question of "catching cold," so interesting in this connection, has obtained ample consideration in

a previous chapter, and does not call for further mention; in the same place the prophylactic aspects of the subject received full attention, and repetition here would be superfluous; the few points not touched upon adequately will be developed as we go on to describe therapeutic details.

Chronic Bronchitis. Chronic bronchitis is not an uncommon affection even in very young children, if we include recurrent bronchitis, which belongs here clinically and for purposes of treatment. On the other hand, cases in which this affection merely complicates a tuberculous process are to be excluded from consideration here; they are best disposed of in connection with the underlying disease. If we adopt the classification just mentioned, we find that we are dealing with a tolerably well-defined group.

We sometimes encounter chronic bronchitis as a primary affection, in hearty, well-nourished children whose apparent robustness is indeed somewhat magnified by the exaggerated development of the thorax that results from the frequent and violent cough and occasional dyspnœa. Chronic pulmonary emphysema, of the type so commonly associated with the chronic bronchitis of advanced life, is rare, if not unknown, in childhood; at this age emphysema is an acute and transitory affair, differing widely in its histology from the lesion of that name in elderly subjects.

Most of the children, however, that come to us with chronic bronchitis, suffer from rickets or its sequelæ, such as a thoracic deformity (pigeon-breast) or a spinal curvature. Next in order come those who present some form of lymphatism, be it a true scrofulosis, or a

glandular hypertrophy in the faucial ring. Not especially rare are the cases associated with congenital syphilis; here the immediate cause usually consists of gummatous deposits, with lymphatic infiltration, about the larger bronchi; such patients usually do well enough under specific medication, but the cure is likely to be accelerated by removal to a good climate. Many of the worst cases are unquestionably the product of experiments in hardening that have miscarried, especially when irrational persistence in the régime of strenuousness has established a vicious circle, as not infrequently happens. These last embody the most telling reply to the relentless advocates of cold plunges and the like for young children, and are a standing reproach to the blind devotees of routine treatment for young and old alike.

In entering upon a detailed review and classification of chronic bronchitis, we may begin by distinguishing three types. First, we have the recurrent cases that suffer from repeated attacks, with more or less brief intermissions, most persistent and severe in the cold months, but sometimes tending to run on into the spring, the summer being relatively free. Secondly, we note the asthmatic cases, presenting similar seasonal variations, but with less tendency to complete remission while cold weather lasts, and attended with the symptom group known as bronchial asthma. Thirdly, there are the cases characterized by free secretion, with or without the development of bronchiectatic cavities, but without any tangible evidence of tuberculosis; this last type is peculiarly apt to follow an attack of measles or pertussis. It goes without saying that many children do not fit exactly into any one of these groups, and the first and

second are apt to run into one another; a case of simple recurrent bronchitis may gradually become asthmatic, and, on the other hand, the sufferer from severe asthmatic attacks may improve so far as to present merely a recurrent cough with abundant rhonchi and tenacious secretion.

The treatment of these cases with a change of climate is anything but simple. Rickets and scrofulosis, including the various phases of lymphatism, are to be managed according to principles laid down elsewhere in this work, but, aside from these complications or underlying disorders, it is not easy to lay down any general rules. So much is clear, that in any event a moderately warm climate, not likely to entail enervation, is to be chosen, so that the child can pass the greater part of the day in the open air, without excessive exposure to cold winds. When we come to the choice between inland and seaside resorts, we find that the authorities differ amazingly; thus, Hoffmann[1] and Keller[2] favor the mild marine climates, whereas Weber and Foster[3] prefer elevated inland sites. The balance of opinion, however, inclines to the former, and we must remember, once more, that the seaside is not necessarily damp in winter, but, on the contrary, has a tendency to be drier than the hinterland in southerly latitudes. Rode's[4] claim of good results at Norderney, even in the cold months, stands almost alone; the raw and damp winter climate on the North Sea coast, with an average temperature little above the freezing point, is the very one we would look on with disfavor

[1] Op. cit.
[2] Monatsschrift für Kinderheilkunde, Oct. 1903.
[3] See bibliography.
[4] Berliner klin. Wochenschrift, April 13, 1896.

in treating chronic bronchitis; Périer[1] distinctly rejects the far milder coast stations of France, even those of the southeast (Cette), with a doubtful exception in favor of the Riviera.

California and the warmer Mediterranean resorts are therefore quite suitable, and the South Atlantic coast ranks just a little lower. Our Middle Atlantic coast must be employed with some discrimination, as the temperature is a little too low, though there is a high proportion of sunny days; in view of the high and frequent northwest winds this section is best reserved for the purpose of bridging over the treacherous period of early spring, or for an after-cure. The same may be said even of the milder stations of western Europe, as the English Channel resorts.

I see little occasion for dilating on the treatment of these cases in the mountains, during the winter and early spring, for the weather is quite certain to be too cold and windy. An exception may be made in the case of the southern Alleghanies and the southern slope of the Alps, as well as the Pyrenees, in early spring, before the final return north. We shall always do well to adhere to the rule of extending the course of treatment over the entire cold season, that is, until the temperature at home begins to average from 50 to 55 degrees.

After the above general review, we may glance at a few exceptions. First, as to the asthmatic cases, we are in a sort of quandary; Avellis,[2] for example, says that only children are likely to improve at the seashore, admitting, at the same time, that no climate guarantees

[1] Loc. cit.
[2] Münchener med. Wochenschrift, Nov. 15, 1904.

relief; Osler[1] praises California and Florida; Holt[1] prefers a drier climate than the latter, with some elevation; Henoch[1] thinks that an inland resort should be selected to inaugurate treatment in any event, and reserves the seaside for an after-cure, as being of uncertain value. On only one point do the authorities agree, namely, that high elevations are objectionable; otherwise the differences of opinion are so great as to impress us chiefly with the empirical status of the whole matter. It is evident that the climatic treatment of asthma is unsatisfactory, though perhaps not quite to the degree experienced in adults.

We may now turn to those cases of bronchitis, a fairly large proportion of the total, that are characterized by abundant and not very viscid secretion, with or without demonstrable bronchiectases. Here we find little diversity of opinion; it seems to be quite generally agreed that these patients do best in a dry climate; in this connection, however, it is of interest to note the very scant reference to the very arid desert regions, an omission readily accounted for. It is indeed plain that extreme drought, with its inevitable fine dust, is one of the worst possible irritants to the inflamed bronchial mucosa, and the wise physician will precede the ultimate disposal of this class of cases with a glance at the tables of relative humidity as well as the temperature, choosing a climate having 65 to 75 per cent. of moisture, with a reasonable amount of rain to obviate dustiness. This last annoyance is mitigated to a great extent on the eastern slope of the Rocky Mountains, where afternoon showers are not uncommon in spring and early summer; between showers the

[1] See bibliography.

atmosphere there is quite dry. The summer months are very much too arid in California, away from the coast, and the dust forms a fearful plague. At best, the western half of the continent, with very few exceptions, while unsuited to the treatment of asthmatic cases, is more likely to benefit cases with excessive secretion and bronchiectases; selected patients of the latter group may be referred to such regions as the eastern slope, with some prospect of affording relief.

Apart from the cases with free secretion, just disposed of, there is little of real importance to be said concerning a suitable summer climate. The simple and recurrent cases improve in summer in any event; we shall do well, however, to avoid high elevations, very low temperatures, high winds and sea fogs. The asthmatic cases present so uncertain a proposition that we are driven to resort to individual experimentation whenever the mere arrival of summer does not occasion improvement.

In closing the discussion of the treatment of chronic bronchitis, we may emphasize the importance of treating any discoverable underlying affection; it is a curious fact that the primary cases afford the more vexatious difficulties in therapy, and medicinal treatment is even less satisfactory than climatic management, so far as cure or permanent amelioration is concerned.

Chronic Affections of the Upper Air Passages. Apart from such cases as merely complicate lymphatism, the principles stated in the paragraphs on chronic bronchitis apply here also in a general way; our guide is once more the amount of secretion, according as we are confronted with a hypertrophic or an atrophic catarrh. Solly[1] goes

[1] Journ. of the Amer. Med. Association, Nov. 14, 1903.

into the merits and deficiencies of the climate of Colorado, for the treatment of this group, in fairly minute detail. He observes that nasal obstruction usually becomes aggravated, and that respiration becomes more impeded; operative measures that were regarded as optional in the east, become imperative in the Rocky Mountain region. Atrophic rhinitis and ozæna also grow worse, the dryness and dust being extremely deleterious; moist hypertrophic rhinitis, on the other hand, regularly undergoes improvement in this climate. It is just as well, however, to remember that the transformation of hypertrophic rhinitis into the atrophic form is apt to be favored by excessive dryness; we shall therefore not go far astray in regarding Solly's opinion on the hypertrophic group as somewhat optimistic. The abatement of a nasal blennorrhœa does not necessarily denote real progress, and its transformation into an atrophic condition, possibly with ozæna, is of doubtful advantage to the patient. In any event, it is usually advisable not to encourage too long a stay in the semi-arid regions, unless we are pretty thoroughly convinced that there has been real improvement; as a general thing, better results will be achieved at the moderately moist resorts even in markedly hypertrophic cases with a good deal of secretion. The atrophic cases unquestionably do best at the seashore, and even the most typically oceanic climate is hardly too damp for them.

All forms of nasal catarrh are influenced unfavorably by cold and dry winds of the mistral type; it is indeed probable that they are largely responsible for the excessive prevalence of these affections on our continent. Warm and moist air is quite certain to be beneficial; a

really high temperature is, however, not needed, an average range of ten degrees or so above the freezing point being quite sufficient; the semi-southern coast climates will therefore be found quite satisfactory during the cold season.

I have repeatedly found that persons who suffered a good deal from nasal catarrh in the dry and dusty climate of the Great Plains, experienced marked relief when residing in New York, except in the rather dry and very windy period from December to March. During the warm and damp New York summer we hear but few complaints from these patients; all forms appear to undergo a relative improvement during that time.

The lymphatic hypertrophies in the naso-pharyngeal region are often intimately connected with local lesions of the mucous membranes, though at times merely part of a general lymphatism; the rules for their climatic treatment follow those just indicated for the underlying catarrh. The very moist climates are not especially good in these cases; they are too relaxing, even if they would not add to the difficulties of normal nasal respiration. Far worse, however, are the cold and dry climates; here we regularly observe an increase in the tendency to mouth breathing, which becomes especially conspicuous on entering a warm apartment after exposure to a brisk northwester. It is easy to understand the harmfulness of mouth breathing in cold weather; the alternation of high and low temperature seems to add to the mischief, and the effect of the overheated and dry air of most dwellings undoubtedly is worst of all.

Pneumonia and Pleurisy. The pneumonia cases that concern us here are those with delayed resolution, for

which Holt well says that change of air is more important than all other forms of treatment combined. In winter and early spring, the usual seasons in which we encounter this condition, the removal should be to a decidedly warm climate, especially in the case of an infant, for whom the more southerly Florida stations are none too warm. Only after all the physical signs of consolidation have disappeared, may transfer to a more bracing climate be attempted, and in any case the return north is best postponed until the middle of spring. During the warmer months an unresolved pneumonia does not require removal to a very different climate, but even then the change to a sheltered inland locality is advantageous. The seashore is not particularly good for these cases, and the higher mountain resorts are apt to be too cold; the situation often calls for the exercise of considerable judgment, but the physician will not go far astray by recommending a climate such as that of interior New York and New England during the warmest months, and New Jersey in the early autumn.

A point to be remembered in this connection is that the patient is usually not in condition to withstand a long journey, and it is therefore advisable to select the nearest locality that is likely to prove beneficial, in preference to a slightly better, but more remote resort.

Chronic interstitial pneumonia, with or without bronchiectases, is to be managed according to the individual case; the more robust subjects may be treated like those of simple bronchiectasis, the more feeble ones demand the greater care appropriate to unresolved pneumonia; here, too, there is plenty of opportunity for wise discrimination.

Under the head of pleurisy we are mainly concerned with the treatment of the later stages of empyema. Suppuration is apt to continue for months after surgical intervention, and the danger of a general deterioration of the patient's condition is an important item. The best climate to begin with is the one we would select for an unresolved pneumonia; if the child's general health is fairly good, a slightly cooler region may be even more beneficial. The greatest importance attaches to the post-suppurative stage, when pleuritic adhesions interfere more or less with the expansion of the lung. Here a stimulating régime is called for, the child should spend the following summer at one of the cooler seaside resorts or at some elevation inland, for at this period enervation is the chief danger. The best places of all are probably the Alpine resorts, even the colder ones at elevations exceeding 3,000 feet; next come the higher stations of New England and New York; Colorado is perhaps a little too warm during the day, but otherwise ranks high, owing to the large proportion of sunshine. Of seaside resorts those of western Europe and our extreme northeast rank about equally high; as we go south from the English Channel or Maine the climate becomes progressively more relaxing and less suitable to these cases. On the Pacific Coast only certain spots, such as the sheltered portions of San Francisco Bay (*e.g.*, San Rafael), interior Oregon, and Puget Sound, are neither too warm nor too raw.

The other forms of pleurisy calling for climatotherapy are mostly associated with tuberculosis, and occur in older children, whereas metapneumonic empyema is peculiar to infancy and early childhood. For the man-

agement of the former the reader is referred to the paragraphs devoted to tuberculosis.

A few words may be added on the sanatorium treatment of chronic respiratory diseases in children. It is notorious that these cases do not do well in the ordinary hospital and are apt to fall an eventual prey to grave anæmia or tuberculosis. Much of this, however, is due to errors in hospital management and is not true to the same degree of the most modern institutions. The weak spot of the general hospital is its lack of accommodation for convalescents, to which group these children most emphatically belong. Winter sanatoria are unfortunately still a novelty in this country, whereas Europe has been most plentifully supplied with them for decades. Only institutions of this type are adapted to the successful handling of this class of patients, for empyema and unresolved pneumonia, though occurring in well-to-do families, are pre-eminently diseases affecting the ill-nourished children of the poor.

In one respect the foundation of a sanatorium for this class of cases presents some difficulty. A mild climate is quite essential, but is not obtainable within many hundreds of miles of our northern cities; to start such an institution in the South involves possibly legal obstacles, and certainly an expense for transportation that would prove burdensome; the difficulties of adequate supervision must also be considered. It is evident that the matter is far simpler in such countries as England and France, where a really mild winter climate is at the most five hundred miles away from, but generally much nearer to the great centers of population. The problem afforded by this situation is assuredly worthy of serious

consideration by the medical profession and the charitably disposed public; the amount of physical impairment, associated with the far from negligible increase in the death-rate of young children, that is inseparable from our present methods, urgently calls for a remedy, to which foreigners have already shown us the way.

Pertussis. The climatic treatment of pertussis has hitherto been somewhat neglected; a strange circumstance, in view of the fact that it is almost the only one that really amounts to anything. The subject may be attacked from two points: first, as to the influence of a change of climate on the disease itself; secondly, as a prophylactic measure against the complications which form the chief danger of this otherwise not very serious affection. We shall begin with the former indication.

Every practitioner has observed the benefit that children with whooping cough derive from a stay out of doors. The attacks are always fewer and milder in pure air than in the more or less vitiated atmosphere of the house, and the patient should be at home during the day as little as possible. This presupposes suitable weather, is easily carried out in summer, but becomes a most difficult matter in the northern winter, especially where infants are concerned. During the first year of life, removal to a mild winter climate, where there is plenty of bright weather, is almost imperative, whereas older children, especially after the second year, may stay North in a fairly sunny region such as the Middle Atlantic Coast, where outdoor exercise is possible on a good many days, save in unusually cold or stormy seasons. In the Lake Region and the extreme Northeast or Northwest this is not often possible, and a change of climate is best

for older children also; this need not be radical, and New Jersey, for example, is almost always sufficiently mild and pleasant.

It may be added that cases occurring during the summer, south of Mason and Dixon's Line, do better farther north than at home, because they are less apt to be deprived of the outdoor air by intensely hot days, which often necessitate staying indoors during the brightest weather and best hours.

The second indication refers chiefly to the danger of pneumonic complications, especially in winter and spring; as to simple bronchitis, prophylaxis is quite ineffectual, and few young children escape. In summer these children, especially in the cities, are peculiarly liable to diarrhœal diseases, fostered by a state of malnutrition in consequence of the frequent vomiting of food and the exhausting paroxysms. Both these considerations are extremely important during infancy, but become less serious with advancing age.

It is a good rule to treat babies suffering from whooping cough exactly like cases of chronic bronchitis or unresolved pneumonia, according to the general state of health. The climate selected should be decidedly mild in the case of infants, for older children it may be more bracing. In summer the best plan is the one outlined as a prophylactic against gastro-intestinal disorders; here again, however, we must take infants to moderately warm resorts, for they run a considerable risk of pneumonia even in summer, when sudden variations of temperature take place.

Do patients with pertussis get on better at the seashore or inland? American observers, as Holt and

Powell,[1] incline to recommending the former; Szegö[2] is in doubt, and thinks that pure air inland may be of equal value; Fischl[3] is convinced that the paroxysms are mitigated in the moderately warm mountain resorts, but that the terminal stage is cut short at either the seaside or among the hills. From the above divergence of opinion, I have come to the belief that the essential point is freedom of the atmosphere from irritating matter, chiefly smoke and dust; this position is substantiated by the familiar observation that the paroxysms, that in town persist for many months after the disease has run its course, and which physicians as well as laymen are apt to misinterpret as persistence or recurrence of the whooping cough itself, usually cease promptly when the patient is removed to either the mountains or the seashore. Pertussis seems to be regularly followed by increased irritability of the epiglottic mucous membrane, and the avoidance of smoke and dust seems almost indispensable as an after-cure; thus, any good country resort may meet the indication.

No climate seems effective in cutting short the disease itself; the most we can do is to moderate the intensity of the paroxysms according to the method just stated. The efficacy of the saline sea breeze is mythical; the balsamic air of pine woods is a mere tradition, coniferous forests are simply freer from dust than deciduous woods. The infinitesimal traces of resin in the "piny air" cannot possibly have therapeutic value comparable, for example, to the inhalation of cresol vapor, which seems

[1] See bibliography.
[2] Archiv für Kinderheilkunde, 1899, vol. 27.
[3] Berliner klin. Wochenschrift, May 21, 1906.

to be of some little use. It is time that the medical profession ceased to imbibe its ideas on therapeutic matters from hotel circulars and railway folders.

The main obstacle to the climatic treatment of pertussis is the difficulty of finding a locality where other children will not be infected by our patients. Fortunately, this disease occurs in such peculiarly sweeping epidemics that the proprietor of a suitable resort will occasionally find profit in catering to this class of patrons exclusively.

Hay-fever. Hay-fever is not excessively rare in older children; Wyman[1] claims that fifteen per cent. of all the victims of this affection have their first attack by the tenth year. We have already referred to the recent discovery of a specific therapy, but this, while undoubtedly correct in principle, does not give permanent relief, and has scored a considerable percentage of failures. It is therefore simpler, and preferable for other reasons also, to take the affected children to the immune summer and autumn resorts, whenever circumstances will permit. The choice of locality must be in accordance with the data given in the first chapters; the results are then striking, relief being afforded almost instantaneously; moreover, these immune climates are otherwise ideal for most children, notably those of the age here under consideration.

If it is desired to avoid the onset of this affection entirely, the patient must leave his home before the pollination of the ragweed begins. This happens about the middle of August in the latitude of New York, and Boston. The map at the end of the first chapter gives

[1] Autumnal Catarrh, 1885.

the immune regions in a rough way, by indicating the July isothermal of 66 degrees at the lower levels; relief may, however, often be obtained in more southerly latitudes in the Alleghanies by ascending the mountains. The altitude, approximate of course, of the immune line in the eastern highlands is as follows:

St. Lawrence Valley, near Montreal	800 to 1000 feet.
White and Green Mountains, Adirondacks	1200 to 1400 "
Berkshire Hills and Catskill Mountains	1800 to 2200 "
Pennsylvania	2400 to 3000 "
Virginia and West Virginia	3000 to 3600 "
North Carolina	4000 to 4400 "

South of New York there are very few well-equipped resorts above the stated elevations. In Pennsylvania only a few ridges are sufficiently high; farther south the altitudes named are uninhabited or nearly so, and conditions unspeakably primitive. Only the northeastern hill country is therefore worth considering at all.

The return home should not take place before the frosts arrive; the dates for the first killing frost are nearly the same for Boston, New York, and Washington, falling with almost unfailing regularity in the first half of October, rarely earlier or later.

DISEASES OF THE EAR

The literature on the climatic treatment of aural diseases is rather uneven, very complete and accurate in some points, but almost ignoring others of no less interest; the following outline is therefore somewhat sketchy. Otorrhœa seems to do well at the seashore, especially in summer; even sea bathing, which we should naturally view with suspicion, appears to be distinctly beneficial; some discrimination, however, is called for,

Koerner[1] did not note any relapses of otorrhœa following sea baths, but Danziger[2] advises caution when a perforation of the drum membrane is present, as is indeed obvious; dry perforations are, however, a less serious matter than such as are discharging. It is curious how individuals differ as to the likelihood of water penetrating the external meatus, so as to reach the tympanic membrane and cause distress even in a normal subject, possibly harm in one already suffering from otitis media. The uncertainty in this regard in the particular child under treatment makes any prediction impossible; it is therefore wise, in my judgment, not to permit sea bathing in case there is any discharge, present or recent; also to proceed cautiously in patients with a persistent perforation, even if otific manifestations have been absent for years. If this safe rule be not followed, there will inevitably be an occasional disaster to remind the practitioner that the entrance of sea water into the ear is not an indifferent matter, and he is pretty sure to be blamed severely, even unduly, if the risk was taken with his advice.

For the winter, I should be inclined to recommend rather mild resorts for children with otitis media, the same as for catarrhal affections in general, and for similar reasons. After all, the disease of the ear is usually a complication of or sequel to an inflammatory trouble in the uppermost respiratory region, and must be treated more or less as an integral part thereof. This is also the reason why this group calls for discussion in this place, following the consideration of the respiratory

[1] Zeitschrift für Ohrenheilkunde, 1900, vol. 36.
[2] Monatsschrift für Ohrenheilkunde, September, 1899.

tract. In pursuance of this same trend of argument, it also seems a good idea to refer patients with a free discharge, especially when associated with a hypertrophic catarrh of the nose or naso-pharynx, to moderately elevated and fairly dry inland localities instead of the seashore.

The scantiness of the literature on aural climatology is intimately connected with an excessive devotion to routine in the application of this form of therapeutics; there has been no individualization to speak of, hence the dearth of satisfactory special articles. Neither has any attention been paid to the possible value of a change in atmospheric pressure, such as is involved in a removal from our lowlands to the Rocky Mountain Region. This might be considered in connection with the earlier stages of otosclerosis, as met with in childhood, the only age at which much can be accomplished. The otologists have still to determine whether such a climate as that of Colorado tends to check or further this disastrous lesion; the subject certainly calls for a detailed investigation, which might profitably include a study of the effects of a reversal of the change mentioned, namely, from the high western plateaus to the sea level.

DISEASES OF THE HEART

There are but scanty data on the climatic management of heart disease in children, for, here again, most of the work extant relates to adults, and is not always applicable to the very different conditions found in the young. The chronic cases, which alone concern us here, fall clinically into the compensated and uncompensated groups, but the dividing line is marked less clearly than

in adults; on the other hand, the effects of a rational therapy are more rapid and satisfactory, for the almost invariable absence of irreparable myocardial and vascular degeneration aids us materially in re-establishing the balance of the circulation. The greater part of the field before us is covered by valvular heart disease of the rheumatic type; we shall begin with the cases that present complete or tolerable compensation.

Compensated Valvular Lesions. In the adult, a perfectly compensated valvular defect does not usually require continuous surveillance; with a fairly intelligent patient, it is generally possible to enforce a regimen as to diet and exercise that will keep matters running quite smoothly for years and even decades. These remarks do not apply to children. Just as compensation is rather easily established in them by appropriate treatment, so it is more readily upset by adverse influences, among which, apart from the great and peculiar risk of intercurrent febrile affections, there is the difficulty of regulating the amount of muscular exertion. It is not easy to keep a child from violent play, still more difficult to obviate the strain involved in frequent and rapid stair-climbing. Now that the New York Department of Education is building schools on sky-scraper lines, without elevators, an ironclad "system" compels children suffering from valvular heart disease to ascend some sixty feet of stairs several times a day at an almost military pace. It is surely time for the medical fraternity to call attention to this grave abuse, which a tenant in an office building would not tolerate for a day. I can personally recall several cases in which protests were unavailing, and a child with barely adequate compensation

was compelled to choose between attending a class on the top floor or doing without schooling altogether. Such are the consequences of a routine in which the individual is completely submerged.

Children with perfect compensation do not demand systematic climatotherapy, with the exception of guarding against enervation; moderate exercise is absolutely essential, for any tendency to flabbiness is a rather serious matter; it is therefore wise to select a fairly cool climate for the summer months. In the precise choice a little discrimination will be necessary, according to the localization of the lesion and the stability of the compensation. Compensated mitral cases, especially where regurgitation is the main feature, do well at considerable elevations; thus, Galli[1] obtained very favorable results at 3,800 feet in the Alps, Determann[2] does not think the Engadine too high in carefully selected cases, and Babcock[3] arrives at a similar conclusion with regard to the Rocky Mountains. So much can be said with some confidence, that these cases do not belong at the warmer and often sultry seaside resorts, where they are apt to lead a rather indolent life, especially in the case of girls approaching puberty. Such children are sure to do better at a somewhat elevated site, where the nights are cool, and the days rarely oppressive; the northern Alleghanies afford no end of suitable localities, but the watering places of Central Europe seem to be even superior, and indeed often well worth the trouble and expense of an ocean voyage.

A severe mitral obstruction, even if fairly compensated,

[1] Riforma Medica, March 23, 1904.
[2] Loc. cit.
[3] Medical News, July 15, 1899.

must be treated with less strenuousness, and the combination with a lesion of the aortic valve requires the exercise of considerable caution, for fear of disturbing a balance at best somewhat labile. These children are often benefited very greatly by removal to a southern region during the winter, avoiding, of course, excessive warmth as tending to enervate instead of tone up the patient. Such resorts as Florida and Egypt are less desirable than the lowlands of Virginia, the southern Alleghanies and Pine Belt, the south slope of the Alps, and the foothills of the Pyrenees, as at Pau. The reader will not fail to observe how strenuousness is gradually discarded as we pass on to the borderland between compensated and uncompensated cardiac disease.

Cardiac Insufficiency. This clinical picture obtains when compensation for a valvular defect has not yet been established by hypertrophy of the myocardium, also when the seat of disease is the heart muscle itself. As in the case of muscular insufficiency everywhere, such cases require a most judicious adjustment of rest and exercise, and every patient must be regarded individually in the administration of these opposite therapeutic measures. Some general rules may, however, be laid down by way of introduction. The high levels, in the first place, are absolutely contraindicated, for their unremitting stimulation to the heart action is likely to be harmful; it is distinctly dangerous to add to the strain on an organ already insufficient, and requiring rest, not exercise; for the same reason the colder seaside resorts are not to be thought of. On the other hand, the warmer marine stations are apt to cause enervation after a time, so that the usefulness of the oceanic climates is rather

limited in this group of patients. Still, the Riviera, southern California, and similar regions may be of value, in selected cases, during the cooler months; and during the summer the coast of southern New England may prove salutary; most other coast stations are too cold or too warm, and especially too windy, to affect uncompensated heart lesions favorably.

We are, therefore, almost entirely restricted to inland resorts at or reasonably near the sea level, with a temperature permitting a very quiet outdoor life, yet not enervating. The range thus afforded is still considerable, varying of course greatly with the season, for it goes almost without saying, and cannot be too clearly understood by the attendant, that the climatic treatment of cardiac insufficiency is a matter of many weeks' duration, if relapses are not to set in promptly. In commencing with a case of some severity, but still in a chronic or sub-acute stage, it is best to begin with a climate just too cool to be enervating. In midwinter northern Florida, southern Georgia, Sicily, southern California and the Riviera are eminently suitable; we may then, toward spring or as the patient improves, advance to a somewhat more northerly and bracing climate, without, however, seeking true stimulation, which we shall do well to reserve for the time of apparently restored compensation, as a sort of after-cure. For the last, a mountain resort, not over 3,000 feet high, is of some value; it is sufficiently bracing to have a tonic effect, and serves as a sort of test of the efficacy of the preceding rest cure.

It is impossible to exercise too great discrimination in the climatic treatment of cardiac insufficiency; all stages

from a rather labile compensation to almost total heart failure are met with, and nearly all may be benefited by an exactly appropriate climate. With children we may look for excellent results in conditions that are almost desperate in later years, so great is the recuperative power of the myocardium at an early age.

It is not within the scope of this work to discuss the methods and admirable results achieved at such places as Nauheim; we shall merely mention that an important element of this treatment is the general hygienic regulation, with a large proportion of climatotherapy. The best evidence of this is the great inferiority in results obtained by means of the so-called Nauheim cures in our cities; and one season's sojourn among the hills of middle Germany between May and September is a convincing argument that the climate there, during those months, is hardly rivaled and certainly unsurpassed. Only in certain hilly sections of New York and New England, so far as this continent is concerned, can we secure a similar combination of pleasantly warm days and cool nights, moderate humidity, and not excessive rains; unfortunately, the medical skill that frequents the German spas is conspicuous by its absence at nearly all similar resorts in this country. It is unnecessary to add that the accurate imitation of the baths themselves is the easiest part of the whole problem, and within the scope of any competent chemist; moreover, very similar springs exist in this country; the surroundings, however, in the shape of well-kept roads and woods, with level paths, also first-rate medical attendance and hotel accommodations, are rudimentary or absent at most of our resorts, and up to the German standard at none. It is really

astonishing that American invalids should be almost compelled to seek health four thousand miles away, when equally good opportunities might lie at their very doors.

Congenital Heart Disease. Most cases of congenital heart disease have little chance of viability beyond puberty or adolescence, but there is a certain proportion in whom the prognosis is relatively good under careful handling. These more favorable cases are usually distinguishable on inspection by the absence or slightness of cyanosis, though this is not invariably the case; markedly cyanotic subjects have survived to middle life and beyond. Very little has been done in regard to studying the climatic treatment of these patients, but a few general points suggest themselves readily. Thus, H. Vierordt[1] wisely proposes wintering in a mild climate; he does not specify very precisely, but an exact recommendation is not possible for a condition whose severity varies so widely. We are once more called upon to exercise discrimination, selecting a rather bracing climate for well-compensated cases, with little dilatation and no cyanosis of consequence, sending the severe types to warmer resorts, but reserving the truly relaxing climates for such patients as offer a rather poor prognosis in any event. Vierordt's standpoint in advising against even moderately high elevations seems wisely taken, and I would extend this to include the colder and windier seaside resorts; congenital heart disease does even worse under undue strain than an acquired lesion, and an upset compensation is often never re-established, even in the very young. In some of the most promising cases, the

[1] Nothnagel, specielle Pathologie und Therapie, vol. 15, part 2.

balance of the circulation is apt to be more unstable than appears on physical examination, for we must remember that, in the congenital group, we are dealing with imperfectly diagnosticable lesions, whose gravity cannot always be gauged when matters seem to be going on fairly well.

Pericarditis. For our purposes only the cases of pericardial adhesions sufficient to impede the heart action need be considered; when the lesion is so serious as to produce this effect the prognosis in regard to complete restitution is regularly unfavorable, for the circulatory impairment tends to grow steadily worse. One of the few measures that have any value in this condition is removal to a moderately warm climate at a low level, where the smallest possible demands are made on the heart. In these, as in the more severe congenital heart cases, it is probably the wisest plan, whenever feasible, to determine on permanent residence in such a region as southwestern California, one of the few sections that offer a comfortable climate throughout the year, for most of the other mild winter resorts become excessively hot in summer. Such a change of abode is the more desirable, as otherwise an annual long jouney, with its risks and annoyances, is inevitable; we are dealing with conditions that are irremediable, and our only thought must be to prolong life with comfort. If an isolated case may be restored to partial efficiency by this, almost the only promising measure, continuance of the achieved amelioration is also largely dependent on favorable climatic conditions, so that in any event a choice of the sort mentioned will be wisely made, provided that the circumstances of the child's family permit a radical and

permanent change of base without involving too serious financial impairment.

DISEASES OF THE NERVOUS SYSTEM

The discussion of the climatotherapy of nervous diseases in childhood presents certain difficulties in classification, but it will suffice, for our purposes, to divide them into groups calling for similar treatment, without going too far into pathological details.

Nervous Irritability and Nervous Exhaustion. It is best to avoid the much abused term neurasthenia in this connection, both because that designation is rather inaccurate to begin with, and for the reason that the picture described under that name in adults is rare in childhood. On the other hand, early life has some characteristic clinical groups of its own that are plainly manifestations of subnormal or perverted nervous functions, yet cannot be regarded as neurasthenic in the current sense.

The nervous disorders here discussed rarely exist alone, but are usually associated with visceral derangements, simple malnutrition or one of the other chronic nutritional or systemic diseases noted in the preceding chapter, sometimes scrofulosis or lymphatism, and so on. This contrasts markedly with the state of affairs in the so-called neurasthenia of adults, which is often associated with almost normal vegetative functions.

Nervous irritability may appear at a very early age, even in infancy, though nervous exhaustion is commoner in the very young. When, however, we remember that there is no hard and fast line between these conditions, which are indeed often mutually interdependent, we

shall have no trouble in recalling infants who showed more fretfulness and capriciousness than nervous inefficiency, and might properly be classed as irritable. The general nutrition of the child suffering from nervous irritability tends to be subnormal, though this is not constant; careful examination will usually elicit one of the deficiencies or diseases mentioned above. In the way of direct etiology, we regularly obtain a history of faulty training; the patient eats unsuitable food and has vicious habits of eating; there is a tendency to excessive mental application and too little life out of doors. Then, there are such items as too much association with older persons, sensationally minded nursemaids, ghost stories, late hours, children's parties, and no end of such other indulgences and perversions as are occupying the time and energies of the young to an increasing extent.

The most characteristic symptom in these cases is a disturbance of sleep. In the mildest ones, the child merely finds difficulty in falling asleep, and is apt to wake up occasionally during the night; those more severely affected dream vividly, the apparitions ranging all the way from mere passing impressions to horrible nightmares and night terrors; grinding of the teeth during sleep and somnambulism are mere variations, and most of the cases of nocturnal enuresis undoubtedly come under this head. Only the very worst cases suffer from real insomnia, characterized by long waking spells during the night, with a tendency to unconquerable drowsiness in the early morning. In this last group nervous exhaustion is sure to supervene in the course of time, somewhat confusing the clinical picture.

The child afflicted with nervous irritability is also quite certain to exhibit characteristic manifestations during the daytime. In the first place, it is highly emotional, being moved to tears or laughter by the merest trifles; it has also a morbid fondness for the impressions that produce these psychical outbursts, and often an inclination toward moroseness or introspection, apt to be mistaken for precocity by persons who habitually underrate the intelligence, mental activity and curiosity of normal children. Secondly, such children are frequently addicted to daydreaming, a state of auto-suggestibility which they induce in themselves with increasing readiness and profoundness, as the neurotic condition progresses. Thirdly, the temper is highly unstable, the temptation being great to set this down to defective training; it is so in a sense, but not the ordinary one; these children are not merely spoiled, accustomed to having their own way, and without respect for authority; on the contrary, they are likely to be well behaved toward their elders, and models of obedience under ordinary circumstances. Their outbursts are always more or less irrational, unpredictable, and altogether out of proportion to the exciting causes; they are more apt to disagree with their playmates than with their parents or teachers.

In our last statements we may, perhaps with some justice, be accused of wandering from the subject, for the general picture we have given bears some resemblance to, and foreshadows, the true psychoses. These are in fact a frequent later phase of the nervous irritability of childhood; degeneration into hysteria is quite common with the approach of puberty, the supervention of one

of the juvenile forms of dementia is a matter of frequent record, the relation to migraine and epilepsy is more doubtful. In addition, many persons who suffer from various types of insanity in later life, exhibit the above picture in childhood, notably when they bear the hereditary taint of a degenerative neurosis or psychosis; in these individuals the symptom group I have called nervous irritability is merely a prodromal stage. Unfortunately, it is just the neuropathic parents of such a child who are most likely to be proud of its "high-strung" disposition, and who overburden its mind in the hope of developing a genius. It is true that genius is peculiarly apt to be associated with just such antecedents, but real genius develops spontaneously, without artificial fostering; more harm, indeed, is done by cramming the minds of these children than of those apparently less gifted but better balanced.

The main and almost sole indication in these cases is rest; to further this there is nothing so effective as a change of air and scene to quiet, even monotonous, surroundings. In this regard the matter of climate is not indifferent, knowing, as we do, that climate may be a powerful stimulant as well as a sedative; as usual, it is easier to caution than to advise, but both are quite feasible. Evidently, hot summers, cold winters, great elevations, excessive drought, and high winds are to be shunned; in addition, of course, we must place an absolute ban on city life, with its nervous wear and tear. Our first object should be to select a fairly genial and moderately moist locality, at a low or moderate elevation, where an outdoor but restful life can be led to its fullest extent. Often, therefore, mere removal from the

city to the suburbs will achieve the end in view, for the irritation caused by the constant and fearful noises of an American city renders amelioration impossible; it is to be understood, naturally, that the neighborhood of railway stations and factories may impair even a rural site very greatly, for our purpose. Other physical, notably hydrotherapeutic, measures, of great value in this condition, do not concern us here, and will not be dwelt upon.

The clinical picture of nervous exhaustion, in its typical development, is quite different. Combinations of nervous irritability with nervous exhaustion are frequent, and the relative predominance of one or the other of these elements is often puzzling; in treating such cases the wisest plan is to consider the latter first, although the former is usually primary.

Cases of nervous exhaustion almost invariably present one of the before-mentioned disturbances of nutrition; the keynote to the entire situation is inadequacy to meet the normal demands on the nervous system; its characteristic psychical expression is best described as apathy. The details previously recounted under the heading of malnutrition fit this group fairly well, if we allow for the relatively greater prominence of nervous, as opposed to visceral, inefficiency. Our procedures also follow closely the rules laid down in the discussion of nutritional diseases, with certain modifications, to allow for the neurotic factor.

In the more severe forms, where the affected child seems totally devoid of nervous energy and will power, and disinclined to anything like physical or mental exertion, even play, we must begin with a somewhat

relaxing climate, that permits sitting and lying in the open air most of the day, without having to consider the question of warmth; the last point presents some little difficulty, in that these patients require a temperature somewhat higher than is advisable for normal children. After distinct improvement has set in, a more bracing climate should be sought without delay, for enervation is particularly undesirable in neurotic patients. On the other hand, it is a grave error to inaugurate the treatment of severe cases with removal to a mountain resort, and the benefit of high altitudes, even when improvement has clearly set in, is very doubtful. S. Brown[1] and Pearce[2] have pointed out that the limit for bad cases is a few hundred or, at the most, 1,000 to 1,500 feet; as progress is noted an ascent may be made to 3,000 feet, but this is the outside extreme. In the Rocky Mountain districts the intense stimulation of bright and almost unremitting sunshine, sudden and frequent changes of temperature, and the excessive dryness of the air, is apt to aggravate rather than ameliorate the child's condition; insomnia is apt to come to the front as a distressing and ominous symptom. The good results noted by Determann[3] and Krafft-Ebing[4] in certain phases of the torpid neurasthenia of adults bear little if any relation to the subject here in hand, the type of disease referred to is of more than doubtful occurrence before adolescence. We may, furthermore, even at the risk of appearing wearisome through repetition, again refer to the different reaction of children, as opposed to adults, with

[1] New York Med. Journal, July 17, 1897.
[2] Ibid. October 5, 1901.
[3] Loc. cit.
[4] Nothnagel, spec. Path. u. Ther., vol. 12, part 2.

respect to hardening procedures, among which removal to cool climates at high elevations unquestionably belongs; in fact, Hecker,[1] as before stated, observed that systematic hardening entails conspicuously bad results in this very group of children.

The more bracing seaside resorts are almost or quite as harmful in the severer stages of this neurosis. We may again refer to the remarks by Ide[2] on the overstimulation due to high winds and excessive sunlight, including its reflection from the water, sand, and rocks; these agents have anything but the sedative effect that is urgently demanded by the victims of nervous exhaustion. In milder cases, however, or in the severer ones when a distinct improvement has been noted, such mild seaside resorts as southern New England and Long Island from June to October, and the South Atlantic Coast during the winter, with Atlantic City or Old Point Comfort as an intermediate station, may be chosen with every prospect of success. The west coast of Europe is, speaking generally, rather too stimulating; Périer,[3] for example, does not recommend either the Channel or southwestern resorts for neurotic children, though he looks on the Mediterranean shore with favor. It appears, however, that the resorts along the English Channel and the Baltic Sea, as well as on the New England Coast, from Bar Harbor southward to Boston, are invaluable as an after-cure, when also sea bathing, cautiously administered, is sure to be beneficial. The really raw marine climates, such as are found in our far Northeast or Northwest, or along the North Sea, are best avoided

[1] Loc. cit. [2] Loc. cit.
[3] Loc. cit. and Annales de méd. et chir. infantiles, 1899, p. 613.

altogether; the more so as sea baths are entirely out of the question in those parts.

Our main reliance in treating the neuroses of children are the low or slightly elevated inland localities, where our range of choice is fortunately ample, for the exact temperature need be regarded only in the very severe cases. Such places as the Italian Lake Region, southern Tyrol, the Lake of Geneva, praised by Bergougnian,[1] and our southern Alleghanies, are not too cold, even in midwinter, for the milder neuroses, save possibly in exceptionally severe seasons; all the warmer stations, short of those that are actually subtropical, are likewise eligible. Good judgment should, of course, be exercised, and here also, as in the treatment of malnutrition, I should prefer to individualize according to age, and reserve the colder group of resorts, during the winter months, for children of the school age; they are, however, excellent spring and autumn stations for all ages, and cannot be recommended too highly in this respect.

In summer, all the moderately elevated sites in the Middle Atlantic and New England States, as well as central Europe, are available and quite sure to be useful. In the Pacific States a choice must be made with some care, but the great valleys of western Oregon, and many places in the interior of Washington are quite good from June to September, the dry season.

A few words may be added on nervous exhaustion in infants, of which Northrup[2] adduces some typical examples at ages of only a few months. In such cases the home surroundings are so evidently at fault, that a

[1] La pédiatrie pratique, 1903, No. 3.
[2] Archives of Pediatrics, January, 1905.

change of climate will effect little, if anything, unless assisted by a correction of the mismanagement of the baby, and the installation of an intelligent nurse. With these improvements, however, satisfactory results may often be attained at home, and a long trip avoided, though frequently, in the colder months, removal to a genial climate, and in summer a stay in the country, will facilitate a cure very materially. This phase of the subject is only now arousing attention, but its importance cannot be overrated; it is reasonably certain that many cases of nervous exhaustion in children have been assiduously cultivated from earliest infancy.

Enervation. The condition somewhat loosely called enervation, referred to so frequently in this work, is of particular interest to the medical climatologist, and merits an extended discussion. We may begin by observing that enervation is not properly a form of nervous exhaustion, but of debility, analogous to the condition in the muscular system called flabbiness, as distinguished from tiredness. It is characterized by a deficiency in reactive power in responding to ordinary meteorological as well as other physical stimuli; the patient has either not been trained to resist untoward influences, or has forfeited this faculty from disuse; he is therefore in a condition the exact reverse of hardened.

In addition to distinguishing enervation from nervous exhaustion, we must also differentiate it from certain types of neurasthenia, common in adults, but rare or unknown in children, where the symptom of sluggishness is the misleading factor; outside of this torpidity, the two diseases have almost nothing in common.

I have attempted to draw up a small diagnostic table

illustrating nervous irritability and exhaustion, and enervation; the reader must understand, however, that the data given therein are to be employed only as guides. Combination of any two or all three of these neuroses are quite common; the one fact alone, that the enervated nervous system is especially liable to overexcitation or exhaustion accounts for this circumstance sufficiently.

	Nervous Irritability	Nervous Exhaustion	Enervation
1. General appearance.....	neurotic	apathetic	flabby
2. Nutrition..............	normal or subnormal	subnormal	normal or above normal
3. Susceptibility to physical influences............	normal	increased	very great
4. Emotional susceptibility.	excessive	subnormal	normal
5. Physical energy.........	capricious	subnormal	subnormal
6. Psychical energy........	excessive	subnormal	normal or subnormal
7. Vegetative functions....	irregular	subnormal	sluggish

The observations under the first heading characterize these three groups well, in a general way. In enervation, as will be observed from the table, nearly or quite normal mentality is associated with a subnormal physique, in nervous exhaustion the impairment is more diffuse, but affecting the psychical functions rather more than the physical. The keynote to nervous irritability is capriciousness and unstableness.

The etiology of enervation consists essentially in pampering and coddling. The patient has lived in too warm and even a climate, or has been protected from adverse weather conditions more than necessary or advisable. It is, therefore most apt to be encountered among the residents of southern latitudes or well-to-do families farther

north. The logical treatment, of course, is hardening, and this might be adopted in the adult at once and with considerable strenuousness. We have, however, seen the untoward effects of severe measures in young children, and must therefore modify this plan very materially at that time of life. Transfer to a cooler climate, beginning in the late spring, whenever possible, is perhaps the least harmful method of hardening, and we may thus gradually accustom such children to northern weather. To advance to this degree is, of course, only desirable if a permanent change of residence is held in prospect, otherwise it is quite useless to go to the trouble of gradually inuring southern children to the rough conditions of higher latitudes. For such as are to return South, removal for the summer only is called for; the locality selected should be decidedly cool, averaging 64 to 66 degrees for older children and 68 to 70 for infants, in July and August.

A good practice for residents of such very enervating climates as that of our Gulf Coast is to send their children North toward the end of April or beginning of May, when the mean temperature rises into the seventies, and not permit their return until well on in October. Such a measure naturally entails heavy expense, also considerable trouble, but the reward is reasonably sure, for the summer of the far South is extremely injurious to very young children, making them excessively susceptible to the first cool nights of September or October, even when the summer itself has passed without severe illness. It is worth noting that children born in the North have great difficulty in becoming acclimated in our southernmost sections; they become badly enervated in a few

months, apparently far more thoroughly than the natives, and the consequences are most serious. It is commonly assumed that the chief danger to such children lies in acute or chronic diseases of the alimentary tract; this peril does exist, but is exceeded by the extreme risk of contracting fatal respiratory affections from trivial exposure. Crombie[1] has effectively dwelt on this circumstance in the typically, but not in the very highest degree, enervating climate of India, where the mortality of pneumonia in young children amounts to fifty per cent., though the morbidity from that disease possibly does not equal that of northern regions. We have noted, in the first chapter, the high death-rate from this disease in our southeastern states; the cause is undoubtedly the same as in India.

Insomnia. The question whether or not a patient is suffering from insomnia is not to be decided merely by counting the hours of sleep, but requires a somewhat complicated and searching analysis. Holt gives the normal amount of sleep as follows:

Age	Hours
One year	14—15
Two years	13—14
Four years	11—12
Eight years	10—11
Twelve years	9—10

Children vary, however, very much as do adults; a range of an hour or more in either direction is still compatible with normal health. The seasonal variation must likewise be regarded; about an hour less than the above figures is required in summer, as much more in

[1] British Medical Journal, Sept. 14, 1901.

winter. A child of one year may, therefore, demand as much as 17 hours of sleep in winter, and as little as 12 in summer, without the necessary inference of anything pathological.

A history of interrupted sleep is most important; never quite normal in the adult, it is distinctly morbid in childhood, and if not dependent on external influences (noises, etc.) or physical pain, becomes an exquisitely neurotic manifestation, usually associated with general nervous irritability. It is rare to note this symptom without evident sequelæ in the early waking hours, such as general torpor, peevishness, and an impaired appetite at breakfast; indeed, the absence of all of the latter symptoms justifies a skeptical attitude as to the entire history. As previously mentioned, the severe types of insomnia are rare in children; it is therefore all the more essential to look out for the minor form just described, which is likely to be the precursor of more serious disturbance.

With regard to the influence of climate on insomnia, we may begin with reference to the data in MacFarlane's admirable monograph.[1] Adverse influences are severe cold, intense heat, especially when associated with a high humidity, and high elevations. As to the first, we must, of course, differentiate from the deepening and ultimately fatal coma that results from a marked lowering of the body temperature; the first effects of a low temperature are irritant, and contribute to wakefulness. The irritation due to great heat and humidity has already been touched upon, and the general relative anæmia, with its inevitably concomitant cerebral irritation,

[1] Insomnia and its Therapeutics, New York, 1890.

following removal to high levels, has also obtained ample notice in the first chapter.

The effect of the seaside has been recorded variously as favoring or relieving insomnia. MacFarlane's remarks as to the former may very well apply to the cool and bracing northern coast resorts, whereas the American and other references to the sedative influence of the sea air are certainly more generally applicable. Still, Pearce[1] reports a case that suffered from the high winds at Atlantic City, but obtained relief at Philadelphia; it is doubtful if any other city in this country can boast of a parallel achievement, save possibly in the outer suburbs.

All authorities seem to agree on the benefit to be derived from a sojourn at moderately elevated and reasonably mild inland stations.

The Spasmodic Affections. For our purposes we may throw this heterogeneous assemblage of diseases under one heading, to save space. Chorea, of the rheumatic type of Sydenham, requires detailed and distinct consideration, for, apart from any associated articular or cardiac symptoms, it is likely to undergo considerable amelioration in a suitable climate. We may distinguish between two sets of chorea cases, namely, the mild and the severe, as they present a clinically very different picture, and call for entirely different treatment. The milder cases, well nourished, and in generally fair condition, require only the moderately sedative regimen indicated in other cases of nervous irritability. The severe cases, however, which present symptoms of physical as well as nervous exhaustion, are often serious enough to call for rest in bed as a preliminary treatment, followed

[1] Loc. cit.

by removal to a very mild and sedative climate, even one of those near the enervation point, which are too relaxing for most invalids. After all, however, we are here applying a treatment similar to that advised for nervous exhaustion, only in a still higher degree. Of course, as progress is noted, it is well to transfer the patient to a more bracing climate; in any case, several months will be required for a cure.

The habit spasms, including *tic convulsif* and stammering, may be benefited by the treatment accorded to cases of nervous irritability in general, of which they are common manifestations. The nodding spasms of infancy are generally associated with a nutritive disturbance, usually rickets; here the indication is to treat the underlying condition. Epilepsy is amenable to climatotherapy only to the extent that a good climate will benefit anybody.

The secondary spastic conditions associated with spinal disease require no separate treatment; we need attend only to the patient's general condition. As a rule, the plan outlined for malnutrition will yield the best results; I would also call attention to the recommendations in the following paragraph, concerning the attendant paralytic affections. In the spinal diseases of children we regularly find contractures and paralyses combined.

The Paralytic Affections. These call for climatic treatment only indirectly. Children afflicted with paralysis require an abundance of fresh air, but naturally cannot avail themselves of exercise to any extent worth mentioning. They, therefore, necessarily require a milder climate than such as are able to move about freely, and

must frequently be taken away from home for this reason. Other things being equal, the seashore commands our first choice; the moist and equable air from the ocean is particularly grateful to these little sufferers, and a judiciously followed course of sea bathing rarely fails to benefit the general health. In the management of the individual cases many variations will suggest themselves, such as a tolerably bracing climate in the later stages of poliomyelitis, and a more relaxing one in the earlier stages, before improvement has begun to set in; a fairly cool and dry climate in facial palsy, where general exercise is possible, but wet weather does harm; and a very mild region in post-diphtheritic paralysis, where the general condition may be far below normal. This field, as a whole, is rather difficult, and does not admit of the laying down of any hard and fast rules; the patient's state of nutrition is a valuable guide, ranking with the capacity for muscular exertion. In view of the rather empirical administration of climatotherapy to many of these subjects, the wisely discriminating physician will often be astonished at the improvement in cases that made no progress at home; a stationary condition in these cases implies deterioration, in view of the secondary changes that are inevitable. It is true that some of these children might likewise have improved under adequate utilization of a fairly good home climate, but it is a matter of daily observation that the mere reference to a well-known health resort seems to reawaken the dormant or flagging interest of the parents. The recommendations of the attendant as to exercise, diet, bathing, etc., are invariably carried out with greater fidelity and exactness at a watering place than at home.

The Painful Neuroses. These play a comparatively small rôle in childhood, but we may nevertheless touch upon a few items of interest. Facial neuralgias in children are usually secondary to otitis media or dental caries, and call for treatment of the primary affection; a few cases, however, are independent of any such connection, and are then likely to improve on removal to a warm and dry climate. The relation of neuralgia to meteorological conditions is precisely similar to that described in the case of rheumatism (page 274); in this connection we may cite an interesting case reported by Weir Mitchell,[1] in which, during seven years, every storm brought on a neuralgic attack. Such a patient will naturally do far better in the western half of our continent, where general storms are relatively more moderate and infrequent in the winter months than in the tempestuous climate east of the Rocky Mountains; the greater dryness westward would likewise afford the patient relief, as nothing seems to favor neuralgia quite so much as a high relative humidity.

The status of migraine among the neuroses is at present in doubt, but a large mass of recent testimony seems to assign to this affection a position among the epileptoid diseases; such is pre-eminently the standpoint of the German school, and my own experience also has taught me to differentiate true migraine from the headaches due to gastro-intestinal intoxication. On the basis of the epileptoid theory, treatment of the digestive tract alone should be supplemented by the régime of rest recommended for the other spasmodic neuroses. Mendel[2]

[1] American Medico-surgical Bulletin, May 16, 1896.
[2] Deutsche med. Wochenschrift, 1906, No. 20.

recommends elevated inland climates in preference to the seashore; the indication thus agrees with that given for the neuralgic affections. Migraine is not at all a rare disease in children, but there are not yet extant sufficient data as to its climatotherapy to warrant more than the above suggestion. The subject has hitherto received little separate or detailed consideration.

DISEASES OF THE SKIN

The integument is the organ most conspicuously subject to adverse external influences, and might therefore be expected to manifest great sensitiveness to the vicissitudes of weather and the variations of climate. It is true that modern clothing acts as a protection against these agencies, but its function is imperfect, incomplete so far as the head and extremities are concerned, and subject both to mismanagement and neglect because of the dictates of fashion and the stress of poverty. Yet this subject has received little, almost no attention, and one of the least frequent recommendations by the dermatologist is a change of climate.

Many cutaneous lesions are quite independent of meteorological conditions, but this is probably true only of the minority, if we regard the number of our patients, rather than the variety of diseases. It is no exaggeration to say that many thousands of sufferers from skin disease can be benefited greatly by a change of climate, and this is conspicuously true of children. Among typically climatic dermatoses, prickly heat (lichen tropicus) is a characteristic example, for which removal to a different, in this case, cooler region is an unfailing specific. Frostbites, chilblains, and the chronic eczema

of the face and hands from which so many children suffer intensely in winter, are promptly benefited by transfer to a more genial zone. These two groups represent most exquisitely the respective effects of hot and cold weather on the skin, aided by a high degree of humidity in the former ailment, and apparently aggravated by a dry atmosphere in the case of winter eczema, though excessively frequent ablutions with cold water seem to play an important part in causing the latter. I have observed patients in whom a winter tour from one of the very damp lake cities (Cleveland) to the drier Middle Atlantic Coast brought on this disease with great promptness, though the temperature at the latter was decidedly higher.

Too little attention has been paid to the climatic treatment of ichthyosis, though it is the obvious corollary to the regular alternation of improvement in summer and exacerbation in winter. The objection, of course, holds good that we cannot cure this disease, or rather malformation, and that removal to a mild and moist climate is merely palliative. Still such removal, for the winter in moderate cases, permanent in the severest forms, is worth serious consideration, in view of the great discomfort these patients often experience.

As to large groups of other cutaneous affections, it will suffice for us to generalize. In most chronic skin diseases it is not easy to separate climatotherapy from balneology, and these two forms of treatment should be combined more often than is the case. It should not be necessary to point out the absurdity of sending patients afflicted with skin diseases to the baths of northern latitudes in winter, or to the corresponding southern

resorts in summer, but the importance of a suitable climate is very often ignored. The value of adequate climatological information to the dermatologist seems obvious, but its possession is rarer than we might justly expect; the appropriate combination of climatic treatment with the prescribed course of baths will be found invariably to increase the efficacy of the latter.

Certain aspects of phototherapy might be referred to in this place, but this department of dermatology is too highly specialistic to be disposed of in a general treatise of this kind; the field, moreover, is still very new, and results are only just beginning to be reported. For an example of what is being done I shall merely call attention to a recent paper by Guhr[1] on the heliotherapy of psoriasis; it is quite likely that we are on the threshold of some very interesting and valuable innovations in treatment, opening up an entirely new field in climatic therapy.

[1] Berliner klinische Wochenschrift, April 23, 1906.

CHAPTER VII

SCROFULOSIS AND TUBERCULOSIS

The great bulk of the literature on climatotherapy relates to the treatment of scrofulosis and tuberculosis; the reader will be struck with the abundance of references on this subject, whereas the other applications of climatic treatment have not called for more than a few dozen articles within the past decade. It will, therefore, be a relatively easy task to handle this chapter in a fairly thorough manner.

In the adult the discussion of tuberculosis of the lungs covers practically the entire field, the other forms of this disease being numerically unimportant. In childhood the situation is altogether different; in the first place the more or less restricted involvement of the lung alone is extremely rare in infancy, and becomes comparatively common only toward puberty; secondly, childhood is characterized by polymorphous and more or less generalized tuberculous manifestations, besides an enormous group of affections, of which the tuberculous character is either obscure or doubtful. It is easy to see that the study of this subject in the young is not only broader and very much more comprehensive, but that it must also be regarded from a somewhat different point of view; in addition there is the constant differential appropriate to early life, which has been so often referred to on preceding pages.

We can take up the entire question most advantageously by beginning with a consideration of the tuberculous and pseudotuberculous affections peculiar to infants and children, commonly designated as scrofulous.

SCROFULOSIS AND LYMPHATISM

In a monograph of this kind, concerned essentially with therapeutics, it is quite a serious venture to enter on an extended discussion of the relations to one another of tuberculosis, scrofulosis, and lymphatism, especially as complete agreement on the subject does not yet exist. A few remarks, giving a brief outline of the opinions at present prevailing, are, however, necessary and may not be superfluous.

Cornet,[1] in his well-known monograph, distinguishes the following forms of scrofulosis:

1. Tuberculous, caused by the tubercle bacillus;
2. Pyogenic, resembling the former very closely clinically, but caused by streptococci and staphylococci, not necessarily progressing to the formation of an abscess;
3. Mixed tuberculous and pyogenic infection.

The second group, only apparently tuberculous, yet undistinguishable save by refined laboratory methods, leads up to a series of cases that have often been called scrofulous, but are as frequently, nowadays, designated as manifestations of lymphatism. The term "lymphatism" at present includes a wide or narrow field, according to the taste and fancy of the author; for my part, I prefer to limit it to that group of infants and young children who have been variously described as suffering

[1] Nothnagel, specielle Pathologie u. Therapie, vol. 14.

from thymic asthma, congenital laryngeal stridor, or the status lymphaticus. The almost universally accepted view that this clinical picture rests on a glandular hypertrophy, with marked predilection for the thymus gland, surely does not fit all cases, for such recent reports as Koplik's[1] show that many cannot be accounted for by enlargement of the thymus gland alone, and that lymphatism represents a constitutional condition, related to those discussed in Chapter V. I have referred to this group here merely because of its clinical relation to the scrofulous glandular affections.

A few words may also be added in connection with the adenoid hypertrophies of the upper respiratory and faucial regions, which were once regarded as typically scrofulous, but afterwards became relegated to the status of a local affection. The fact is that either aspect of the case may be correct, according to the individual. The majority of cases seem to be merely secondary to local inflammatory lesions, and I have therefore referred to them under the heading of chronic rhinitis and allied affections; there is no good reason, however, why they should not be placed in Cornet's second group of scrofulosis. The maintenance of this standpoint is made the more justifiable through the researches of Wood[2] and others, who found tuberculous deposits in a fairly large percentage of these hypertrophies. It is clear that an accurate distinction is not within our clinical resources, and that these glandular affections may be dealt with here as properly as in the other connection mentioned.

Fortunately, all the above theoretical considerations

[1] Archives of Pediatrics, December, 1905.
[2] Journ. of the Amer. Med. Association, May 6, 1905.

have no great modifying influence on our therapeutic procedures, so far as the selection of a beneficial climate is concerned. The indication in the entire group calls for a system of gentle hardening, applied, of course, with considerable regard to individual circumstances. It is much to be regretted that American authors have almost entirely neglected this extraordinarily interesting and important subject, whereas the contributions of foreign observers would fill many volumes; those quoted at intervals below constitute a relatively small part of the total.

The seashore seems most favored by competent authorities, even in fairly cold regions. Thus Rode[1] records very favorable results at Norderney, where the children do well even in the stormy but not intensely cold winter months; warm sea-water baths are administered three times a week. The other German sanatoria report similarly good results under similar management; a marked improvement is said to be effected in six weeks. Grebner[2] rightly claims that the percentage of complete cures would be even higher, if the regulations of the German sanatoria permitted a longer course of treatment; at present it amounts to about a third of the children admitted, though nearly all the remainder show some improvement. The French sanatoria have reached a somewhat higher state of efficiency, D'Espine's[3] recent report from Cannes being especially worth noting; the course of treatment averages five months, against six weeks at Norderney, and this accounts, at least in part, for the good results at that station, though we must not

[1] Loc. cit.
[2] Jahrbuch für Kinderheilkunde, 1896, vol. 42.
[3] Archive de médecine des enfants, 1904.

forget that Cannes is about twelve degrees warmer in winter, and has two or three times as many pleasant days. At the French sanatoria on the Mediterranean it is the custom to give the children sea baths through the winter; they are not intermitted even during cold spells, when the thermometer is near the freezing point. So strenuous a procedure seems to me of rather doubtful merit, in view of what we have learned of the effects of cold baths; the Mediterranean is remarkably warm in winter, but its temperature along the Riviera averages only 55 degrees in January and February; I am inclined to believe that these baths might well be exchanged for warmer indoor sea-water baths from December to March or April.

D'Espine admits that the summer at Cannes is a little too warm; its temperature is similar to that around Delaware Bay; there is therefore considerable risk of enervation at that season. During the warm months, however, there still remain the resorts on the Bay of Biscay and the English Channel, on which Périer[1] and Robin and Binet[2] bestow the highest possible praise. Along the Bay of Biscay the water is sufficiently warm for short sea baths in summer and early autumn. Weber and Foster[3] recommend the winter stations on the north shore of the English Channel only for robust children; for cases showing marked enfeeblement they decidedly prefer the Riviera. This opinion diverges somewhat from those we have quoted, since the Isle of Wight, for example, has a winter temperature about half way between that of Norderney and the warmest points on

[1] Loc. cit.
[2] Archive gén. de médecine, July, 21, 1903.
[3] See bibliography.

the Riviera, with a fair number of sunny days, while the summer climate along the Channel is about the best in Britain. When we proceed to balance these opinions, we must consider that the German and French reports embrace a larger and more scientifically gauged material, whereas the British observers seem to have made a more thorough study of climatic minutiæ, often such as cannot be recorded by instruments of precision.

An important point in deciding on the seaside in scrofulous cases is the presence of a dry catarrh; a tendency to febrile temperatures and pulse frequency also argues for one of these resorts, but in such subjects any tendency to bleakness should be avoided.

Turning to American resorts, hitherto so sparingly exploited, we may find climates similar to the above from Long Island to northern Florida in the east, and from San Francisco to San Diego in the west, during the winter months; those farther north are too cold on the Atlantic side, and too wet and stormy on the Pacific. Of the eastern stations those north of the Virginia capes are somewhat too severe from the middle of December until the end of March, save for fairly robust children, Atlantic City being quite as cold in winter as the North Sea coast of Germany, though far less cloudy; both have a tendency to high winds, which are apt to be damp and mild along the North Sea, but dry and piercingly cold in New Jersey, with temperatures at times near zero. All the stations on our Great Lakes are too raw, even the mildest are subject to violent storms and deep snow.

In summer it is wise not to select climates that tend to enervate, and I should set New Jersey as the extreme southern limit even for enfeebled children; the coast

east and north of central Long Island is far preferable. In general it is safe to follow the rules laid down in the discussion of enervation. As to sea baths, we have noted the wide variations on our coasts, but may say that at the Atlantic stations, from Massachusetts southward, the water is often sufficiently warm in midsummer for a fairly long immersion that would be harmful in the colder waters of the Californian or west European coast; we again repeat our caution against excess, and our counsel as to the avoidance of a strong surf.

With these ample opportunities afforded on our side of the Atlantic, it is pitiful to record that our summer seaside sanatoria are both insufficient in number, and grant the patient far too brief a stay. As to winter sanatoria, but one exists, opened so recently as the fall of 1904, whereas in effete Europe they have been flourishing for over half a century, the coasts being at present plentifully dotted with them.

Inland resorts have been advocated less than those by the seaside; they have certain advantages when there is an attendant moist catarrh, and in the obstinate and unvarying torpid cases presenting lethargy as a prominent feature. In treating these groups exposed plains are not so desirable as moderate elevations with a good wind shelter; the excellent results obtained at the German and French hill resorts may very well be repeated here, choosing such regions as the southern Alleghanies in winter, and the northern mountains in summer. In the former season the lower levels of the arid Southwest are also worth trying; Phœnix and Tucson are possibly a trifle too dry, but otherwise admirable, whereas San Diego and Los Angeles are a little too moist and relaxing

except in the case of very young, neurotic, or very delicate children. The more robust scrofulous patients urgently call for a considerable amount of hardening.

In Europe flattering results have been achieved by combining one of these inland resorts with saline baths, furnished at a number of spas that afford a delightful climate between May and September. At these places it is possible to furnish a brine much more concentrated than sea water;[1] solutions up to ten per cent. and more are employed in treating the more robust subjects, whereas feebler ones do better by beginning with the isotonic strength of 0.9 per cent. The baths should be prolonged and warm, 95 degrees for enfeebled children, reducing to 86 degrees for the more hardy ones. The indifferent temperature appears to be lower in salt than in fresh water, and the last-mentioned temperature is sufficiently high for a prolonged immersion in many cases.

The rationale of this treatment is thought to lie in a general stimulation to metabolism, undoubtedly somewhat conjectural as to its finer details. For a good account of brine baths, their action and employment, I would refer to an article by Keller.[2] Anything like routine treatment is apt to be harmful, and the exact procedure must be left to an experienced resident physician.

A bath of this sort is readily prepared; still, there has been no attempt made to introduce this treatment in our country; experience is altogether lacking on this side of the Atlantic, although we possess an ideal locality for carrying it out at the popular resorts near Salt Lake City,

[1] The ocean contains 3.5 per cent. of salts, the Baltic Sea 0.7, the Great Salt Lake 22.0; the waters of Kreuznach (near Bingen) contain 1.3, of Reichenhall (Bavaria) 23.0 per cent. See page 196.

[2] Correspondenzblatt für schweizer Aerzte, 1891, No. 8.

where the climate also is eminently suitable during the greater part of the year. It has been suggested that the employment of natural brines is preferable to artificial salt solutions, and that much of the effectiveness of the former is due to the radioactivity of certain ingredients. This statement still requires confirmation, before it can be accepted as a definite fact.

Reports from inland resorts are somewhat less numerous than those from the seashore, but almost equally favorable. Hürlimann[1] shows that a majority of the cases are cured in an average of six months at Ægeri, near Zurich, the reports collected by Monti,[2] relating to the treatment with saline baths are still more glowing, and rival those from the seashore. Practically all the very scanty American reports refer to inland stations at moderate altitudes, but they amount to little numerically and cannot be successfully utilized for purposes of scientific demonstration. Bergougnian[3] speaks highly of Evian-les-Bains, on the Lake of Geneva, and the other French observers do not dissent entirely, though they consider their exceptionally good seashore climate preferable.

The vast similar area in New York and New England, as well as in the higher southern Alleghanies, is surely calling for similar endeavors on the part of our pediatricians; in this country the advantage of the seashore over a large number of available inland resorts, at moderate elevations, is less evident than in France.

[1] XVII Jahresbericht der Zürcherschen Heilstatte bei Ægeri, etc., Zurich, 1902.
[2] Die Kinderheilkunde in Einzeldarstellungen, Heft 8. Berlin and Vienna, 1889.
[3] Loc. cit.

As to the higher altitudes, I think that we must agree with Cornet[1] in reserving them for so-called after-cures. An exception may be made to the extent of sending older children, whose general condition is tolerably robust, to Colorado or New Mexico, where the winter has but few intensely cold or stormy days, and there is little snow. Cornet's remarks refer to the higher Alps, where the winter is certainly too severe for delicate children, and the summer is also rather cold. The mere elevation is not a very serious objection, though not to be disregarded by any means.

To expose an enfeebled child to the winter climate of the Adirondacks is often nothing less than cruelty; the little patient is likely to suffer intensely from the severe cold, and the high ratio of cloudy and stormy days also acts as a depressant. The methods worked out in treating tuberculous adults cannot be safely applied to scrofulous children; now and then, however, an older patient, in or near the teens, may do well in a rather rough climate, especially if a generally good condition be associated with purely glandular involvement, particularly of the very chronic pyogenic type.

TUBERCULOSIS

Many volumes could easily be filled with the literature on the medical climatology of tuberculosis; one might fancy that the specific for this, the most destructive of all chronic diseases, had been discovered. The trend of thought, however, that characterizes the communications flooding medical journalism in these latter days shows clearly that a reaction has set in; the authorities

[1] Op. cit.

are beginning to doubt if any particular climate is of superior value in the management of this affection; one might almost fancy that the experience of decades had been resting on a delusion.

This embarrassing situation, of recent development, is the result of a fallacious course of reasoning, not very difficult to account for. Some years ago, it was the general opinion that the victim of tuberculosis, at least in its earlier stages, should seek the coldest and roughest climate obtainable, so as to be hardened as expeditiously as possible, and enabled to check the progress of the disease by an increase of his resisting power. When patients treated in milder regions were found to do just about as well, it was hastily argued that the element of temperature was not so very important after all; similarly, the excellent results achieved in our moist eastern mountains, almost equaling those obtained in the extremely dry climate of Colorado, seemed to relegate the matter of the relative humidity to the background, though a lame effort is still being made to class our eastern hill climate, as well as that of the Alps, as dry, to save an exploded theory. We are naturally led to ask if such a thing as a climatic phthisiotherapy really exists.

The answer is best furnished with the aid of an historical retrospect. In the middle of the nineteenth century it was still good practice to send tuberculous subjects to the warmest possible climate, Florida, Madeira, and Sicily being favorites, great value being also attributed to the West Indian Islands. Those were the days of the "neglected cold" theory of phthisis, the obvious logical antidote to cold being warmth. From our

present knowledge of the perils of enervation we readily see why these unfortunates usually succumbed rapidly, in such numbers, indeed, as to make the reaction inevitable. Attempts in the opposite direction, made in our western deserts and plains, also in the higher and more lonely Alpine valleys, yielded results that by comparison were nothing less than brilliant; medical opinion then ran to the other extreme, cold and dryness were deemed to be the essentials, though as a matter of fact the high Alpine climate is rather moist; such inclement regions as the far Northwest and the Adirondack Mountains came into vogue. When, however, reports from milder regions, some indeed semi-southern, showed similarly good results, the essential element of a successful phthisio-therapy was decided to be merely a sound system of general hygiene. Here the matter seems to rest at this date, at least in the opinion of very many.

It is not a difficult matter to prove that this point of view is mistaken. In the first place, the sanatoria in mild regions, such as the vicinity of New York City, do not benefit their patients much during the summer months, when the mean temperature exceeds 68 to 70 degrees. Secondly, we begin to hear complaints from southern California of the general infection of a previously immune population with tuberculosis, which would be impossible were that climate really very unfavorable to the progress of this disease. The specialists have now agreed that southern California is too warm for the best results, and reserve this region for enfeebled and advanced cases, who would often do better to stay at home. Thirdly, we need merely repeat the old untoward experiences in the truly subtropical climates. It is plain,

therefore, that warm weather and warm climates are not salutary to tuberculous patients, the reason, as before stated, being the rather rapid development of enervation and a lowered resistance, the early stages of which probably existed at the onset of the disease and invited its invasion.

On the other hand, intense cold is not a necessary therapeutic factor. There is indeed that type of winter weather, with a mean temperature near the freezing point, which in a moist climate involves frequent alternations of snow, sleet, frost, thaw, and rain, with a general average of sloppiness and muddiness, and is objectionable on account of its interference with outdoor exercise and a tendency to fogs. When, however, the temperature keeps well above or below that point most of the winter, also when the amount of precipitation is small, the stated objections do not obtain. The intense cold of the far North or at high elevations is depressing to all but the robust; during the prevalence of temperatures below zero careful attention is needed to keep the patients comfortably warm; in the case of children, who nearly always lack the prerequisite of robustness, the very cold climates are to be recommended only in exceptional cases. Thus we have a difference between the respective management of children and adults, which at a first glance appears fundamental, yet is not so in reality, for the treatment that might well be called subarctic is now well known not to be essential, as it represents an extreme attitude. Judicious hardening is as important in the treatment of tuberculosis in children as in adults; we have seen what limitations must be applied to a scheme of hardening in young subjects, but

the general principle remains the same for them as for older persons.

The polymorphism of tuberculosis in children, as compared with the overwhelming preponderance of localized pulmonary involvement after puberty, has already been referred to. The adult lesion is very rarely, if at all, found by itself in infants, who are so susceptible to the ravages of the tubercle bacillus that the infection in them has a disastrous tendency to become generalized and assume the rapidly fatal miliary type. After the age of three or four years there is a greater tendency to localization, but here also conditions differ from those in later life, in that the bones and serous membranes are far more apt to suffer than the viscera; there is also a decided predilection for the extensive or even universal lymphatic involvement which has been discussed under the heading of scrofulosis. During the years of school life, however, the transition to the adult types of tuberculosis becomes increasingly manifest, so that by the twelfth year the ordinary pulmonary lesions become quite frequent, though their course still tends to be rapidly progressive. Thus tuberculosis in childhood is in every way a matter apart from the phases of this infection as ordinarily understood.

It is plain that we can dispose of our subject to greater advantage, and derive more satisfaction from its study, if we divide the entire field, aside from such mild forms as have already been discussed under the heading of scrofulosis, into the two divisions of surgical and visceral tuberculosis, and pay separate attention to the climatic management of each.

Surgical Tuberculosis. The majority of tuberculous

children, especially between the ages of four and twelve years, belong to this group. Their treatment closely follows that outlined for those afflicted with scrofulosis, so that authors like Cornet consider them under the same title, and draw no dividing line between them.. For our purposes also, it will not be necessary to repeat what was dealt with at length in the preceding paragraphs; we are here called upon to refer only to certain details regarding procedure and results.

To begin with, a sufficient duration of the treatment of surgical tuberculosis cannot be urged too strongly; we have already noted the weak point of the German sanatoria in this regard, and can readily see why Keller[1] says that the results are only fairly good. At the Asyle Dollfus at Cannes children have been kept for eight months, and at other French sanatoria a year or more. Thirty per cent. of cures is not an exceptionally good result under these circumstances, some stations claiming twice as high a ratio. Larsen,[2] for the rather raw climate of Frederiksvärn, Norway (mean February temperature 28 degrees), reports 72 per cent. of cures after an average stay of ten months. Gevaert[3] reports good results from Middelkerke, near Ostende, as the effect of an average treatment of eight months' duration; the winter climate there being not much warmer than at Cape May. As to milder climates, we obtain a most optimistic report from Haudek[4] who records excellent results from Abbazia, on the Adriatic, where the climate is little better than at the entrance of

[1] Monatsschrift für Kinderheilkunde, October, 1903.
[2] Norsk Magazin for Laegevidenskaben, 1901.
[3] Journal médical de Bruxelles, 1902, No. 10.
[4] Wiener medizinische Presse, 1904, No. 46.

Chesapeake Bay; he also insists on a stay of a year or more, if the case seems to demand it. Older reports have been collected by Monti,[1] Brauer,[2] and Uffelmann,[3] reaching back to 1865.

In view of the above mass of statistics, embracing in all no less than twenty-one sanatoria, with the omission of a still greater number, the allowance of a few weeks in summer at our sanatoria for children can be regarded only as a wretched apology for treatment. The patients cannot possibly derive any permanent benefit from such a makeshift; they may pick up a little under the influence of the purer air and better food, but are usually returned to the tenements before the summer is over, and are almost certain to relapse into their original state within a very short time. It is therefore pleasing to note that an attempt has at last been made to establish a winter sanatorium for children in this country. The beginning was made at Coney Island in the winter of 1904–5, and the municipality of New York is apparently making an earnest effort to take up this subject seriously and with a true appreciation of its vastness. Brannan[4] has reported concerning this first experiment at Coney Island, on a very small scale, which was an achievement of private philanthropy;[5] unfortunately, the winter was exceptionally cold, averaging 27 degrees instead of the normal 32, and the results obtained were only fairly good. This was possibly due in part to the excessive amount of snow, and to the prevalence of high and intensely cold northwest winds, but much may also be

[1] Op. cit. [2] Dissertation, Berlin, 1886.
[3] Archiv für Kinderheilkunde, 1881, vol. 2.
[4] Medical News, November 11, 1905.
[5] Adequately endowed on June 30, 1906.

set down to the shortness of the course of treatment, the defect adversely commented on in connection with the German sanatoria. It remains an open question, whether the climate of the coast near New York is not a little too cold and exposed for the best results, and the unusually mild and sunny winter of 1905–6 (average temperature 36 degrees) will not tend to clear the situation, for the next report is certain to be better, under such exceptionally good meteorological conditions. The Long Island coast has, however, the incontestable advantage of abundant sunshine in winter, in which the resorts of western Europe are deficient, and in particular a highly salubrious climate in the autumn months. The spring is rather changeable, and the summer often so sultry that it is doubtful if this region is really very beneficial in surgical tuberculosis during July and August. At any rate, repeated trial is urgently called for before giving up so promising a project, which has a half century of European experience to back it. The attempt to found a sanatorium farther south would entail heavy additional expense, besides involving an almost insoluble question of jurisdiction in case of an official or semi-official enterprise. Moreover, the hostility to sanatoria for tuberculosis is at present growing apace, knowing neither reason nor common humanity, and cannot be ignored by the state authorities, even if the legal difficulties prove quite surmountable.

The older physicians made a distinction between the erethitic and torpid types of scrofulosis and tuberculosis, which has some relation to climatic treatment. The erethitic type comprises "delicate" looking children, slender in build, with an almost transparent skin, poor

development of adipose and muscular tissue, and a neurotic temperament; the torpid type includes heavily built, often quite stout and active children, of a phlegmatic temperament. It is evident, of course, that these groups represent respectively opposite degrees of susceptibility to, or virulence of, the tuberculous infection; naturally, also, a very large proportion of our young patients will occupy an intermediate and perhaps indeterminable position. Often every factor in each case will have to be carefully weighed, if the most appropriate treatment is to be inaugurated.

The main point is that torpid cases may at once be submitted to a plan of hardening at cool seaside or mountain resorts, whereas this method is very apt to injure the severer erethitic cases at the outset. Périer,[1] who recommends the seashore whenever possible, urges the removal of the latter patients to a fairly warm inland resort, at least to begin with; the colder climates are probably best avoided altogether, except as an after-cure. An element that we must not disregard in the management of these children is the harmfulness of too much physical exercise, but when a rather sedentary life is to be led, a mild temperature becomes absolutely necessary, if the child is to spend most of the day in the open air.

The torpid type of surgical tuberculosis is one of the few conditions in which we can recommend a sea voyage; Weber,[2] Williams,[3] and Doyle[4] speak highly of this procedure, and furnish good evidence of its efficacy. The main thing is that a tour of ample duration, like the

[1] Loc. cit. [2] Loc. cit.
[3] Edinburgh Medical Journal, March, 1905.
[4] Lancet, 1890, vol. 2.

popular one to the Mediterranean, be chosen, and that the child be under really good and intelligent management; in that event considerable improvement may be looked for; cruises in the tropics or in notoriously stormy seas are, of course, entirely barred. On the trip I have mentioned there is usually the rare advantage of really competent medical attendance, which I consider quite indispensable.

We have previously referred to the radical change in the management of tuberculous cases that must be adopted if a renal complication or amyloidosis supervenes, and may refer back to those pages. The immediate cessation of every attempt at hardening is of course not favorable to the eradication of the tuberculous process, but we are, most unfortunately, reduced to a choice between two evils, when either of these complications turns up, and the underlying affection, while sufficiently serious, is the one less liable to run a rapidly unfavorable course under inferior climatic conditions.

Such cases as are debarred from exercise by the localization of the tuberculous process in the lower extremities may require a slightly warmer climate in winter than the others; these patients were, for example, those that showed relatively slight improvement at Coney Island. Sitting in the sun on a very cold day is possible only with perfect shelter from the wind, and the sun is, of course, on the windward (west) side of the sanatorium in the afternoon on our most blustering days; thus a certain proportion of the opportunities for outdoor life is bound to be lost.

Visceral Tuberculosis. Visceral tuberculosis in the adult signifies, for all purposes, pulmonary tuberculosis

with possibly secondary implication of other organs, such cases forming perhaps 99 per cent. of the total. In children the pulmonary lesion is less predominant, particularly in the earlier periods of life; during the school age pathological conditions tend more and more to approach those in the adult, so that, at puberty, there is no radical difference from the conditions in later years. In early childhood, visceral tuberculosis has a great tendency to assume the miliary type and become generalized; we therefore rarely have to deal with an isolated affection of a limited area of the lung; intestinal tuberculosis is possibly quite as common, and the occurrence of meningeal complications is frequent. It is not practicable to regard any case in a young child as incipient, as may often be done in older subjects with perfect safety; we shall do better by our young patients, if we consider every positively diagnosticated case as advanced, for there is almost surely more extensive visceral and glandular involvement than is accessible to our diagnostic methods, and the chances for a rapid spread or miliary generalization are much greater. To state the matter concisely, pulmonary tuberculosis in the young child is usually not a local affection, but only part of a more or less general systemic invasion by the tubercle bacillus.

The above considerations have a vital bearing on the subject of climatic treatment; to the previously stated objections to sending young children to severe climates we have added the circumstance that the individual case is usually past the stage for such removal. The prognosis of these cases is, in fact, far worse than the statistics compiled from adult material would suggest; in the

first few years of life it is practically fatal, and even at puberty far worse than in the twenties and thirties, partly for the reasons mentioned, partly from the feebler general resisting power, partly because of the objections to entering upon a severe hardening regimen.

It may not be superfluous to mention the essential requirements of a good resort for the treatment of pulmonary tuberculosis; there are few matters on which the medical world is so generally in accord. In the first place, there must be ample wind shelter and freedom from dust; the former is obtained by the selection of a well-forested region and a hillside with a leeward exposure, which is easterly and southerly in our latitudes, as our worst winds come from the northwest; the latter is secured by fairly frequent and moderate rains in summer and a covering of snow in winter. Secondly, good food, perfect general sanitation, and ample facilities in the way of intelligent medical attendance and nursing, are equally important; the satisfactory combination of these requirements is hardly obtainable in this country outside the better grade of sanatoria, whereas they can be secured by the ordinary visitor at dozens of European resorts. Thirdly, the tuberculous patient requires good roads and paths for short walks, with abundant seats and benches, the latter to be placed as advantageously as possible; here also everything has been done in Europe, nothing at American resorts, with but few exceptions. Fourthly comes the matter of accessibility; this is important only for the poorer classes, as the modern means of travel are rarely very trying to any save advanced cases; the item of expense is the main consideration in this regard. Fifthly comes the matter of temperature, which

is also the easiest to dispose of, for the limits are arctic cold (for children) on the one hand, and enervating warmth on the other, the second being an objection at all ages; this last subject has already received a good deal of attention in this manual, and requires only a few additional remarks, to follow.

We must again repeat that, with the exception of children near the age of puberty, the very cold climates are absolutely barred from consideration.[1] The best resorts are similar to those recommended for the merely scrofulous, when the progress of the disease is slow, and there is relatively little pus formation. The actively catarrhal cases must be referred to inland resorts, which can hardly be too dry. Arizona and the warmer parts of New Mexico are none too arid for cases with free expectoration, provided that there is no laryngeal involvement, and the febrile movement is not severe; Egypt is inferior for our purpose, as it can be utilized only during the winter, and thus renders long voyages necessary and frequent. Weber[2] recommends these climates particularly for cases with albuminuria; our discussion of that symptom on preceding pages quite accords with this view. The main objection to the semi-desert regions is the dust; for the cases here spoken of a little aseptic dust is less harmful than a high humidity. The great advantage of the American desert region is the feasibility of removal to the cooler mountain regions of the West, during the summer; these patients do not suffer at high elevations during the warm weather, even if somewhat asthmatic (Weber).

[1] See, however, Morse, N. Y. Med. Journal, Dec. 1, 1906.
[2] Loc. cit.

Such warm and moderately moist resorts as the Riviera and southern California in winter, and the Middle Atlantic Coast and the Lake Region in summer, are tolerably well suited to the more enfeebled cases, such as have laryngeal symptoms more particularly; but in general it is wiser to send these patients somewhat inland in the warm season. In our discussions on climatology we noted that the seaside is drier than the hinterland in winter and moister in summer; it is wise for the less well-informed to study the humidity tables with some care, and avoid places with figures over 75 per cent. In winter, the colder seashore stations, including those of western Europe more particularly, have proved failures in the phthisis of children, and the same will be found, upon further investigation, to be true in this country north of the 38th parallel.

C. T. Williams[1] says that cases with extensive cavities, fibrosis, severe pyrexia, complicated visceral involvement, and previous degenerations due to residence in warm climates (enervation), do badly in the mountains; the French and German observers, already quoted, say that they do badly at the seaside. As a matter of fact, they are apt to go from bad to worse anywhere and everywhere, but an attempt should be made to arrest the progress of the infection at mild inland resorts, such as the southern slope of the Alps and the Alleghanies; in the latter it is, of course, understood that some such alternation as North Carolina in winter, and New York in summer, be carried out. More enervating climates accomplish no permanent good; the patient may feel more comfortable under their influence, but makes no

[1] The Practitioner, June, 1898.

real progress; the far southern winter resorts should be reserved for hopeless cases, whom it is still kinder to keep at home, if the surroundings there are fairly good.

Some of these courses of treatment involve a journey of several days or a voyage lasting a week or two; we may therefore glance at the contraindications to prolonged travel. Nothnagel[1] thinks that moderate fever does not contraindicate travel; in fact, the temperature often falls and remains normal shortly after arrival. I would not hesitate to send patients with typical hectic fever a comparatively short distance, say 500 or even 1,000 miles, if conditions at home are so unpromising as to lend no prospect of amelioration without removal. Severe diarrhœa, according to Cornet[2] and others, contraindicates travel, which is both difficult and exhausting under such circumstances; this objection does not, of course, apply to a short ride on a first-class railway, such as the four hours' journey from New York City to Liberty, N. Y.

The ordinary pulmonary cases, with or without complications, that affect older children similarly to adults, may now be treated at a number of sanatoria in this country devoted primarily to older persons. These cases are not so numerous as to require the establishment of separate institutions; the results of treatment are similar to those in adults, when the cases are really incipient. As before stated, this point is ascertained with greater difficulty in children than in adults, and we know full well that a too optimistic diagnosis and prognosis is common enough at the latter period of life.

[1] Allgemeine Wiener Medizinalzeitung, 1885.
[2] Nothnagel, specielle Pathologie u. Therapie, vol. 14, part 2 b.

The strenuous hardening measures that often prove extremely valuable in fairly robust men and women are, of course, not to be carried out in young subjects to anything like the same degree; otherwise the treatment need not be varied essentially because of the patient's age; enervation is equally bad for both groups.

Turning now from those cases in which the pulmonary lesion is uncomplicated or predominant to the other phases of visceral tuberculosis, we are confronted with a most trying problem. Meningitis is practically a hopeless affair, but renal tuberculosis is occasionally amenable to climatic measures, when unilateral;[1] pleurisy is almost always secondary to a pulmonary lesion, and does not usually impair its prognosis to a very serious degree. As to tuberculous peritonitis, which is an affection almost peculiar to childhood, we are in less of a quandary than the surgeons, who have a most puzzling operative indication to deal with; the climatic treatment recommended for scrofulosis and surgical tuberculosis is absolutely indicated in these cases, and will certainly yield a fair proportion of good results in this far from hopeless affection. As an after-cure to surgical measures, the removal to a favorable climate is even more important, but in such an event it would be well to begin with a rather mild resort, until the patient recovers a certain measure of strength; then moderate hardening becomes decidedly the order of the day.

SANATORIA

This is perhaps the most appropriate place for the introduction of a few remarks on sanatoria for scrofulous

[1] See Morse, loc. cit.

and tuberculous children. As climate and location have been dwelt on in ample detail, this space may be devoted to less obvious matters. Architecturally, there can be no doubt that the one-story cottage plan answers all purposes best. The cottages may be built of timber or iron, with an attic for purposes of storage and to keep the main floor cool in summer, but not for occupancy; the entire structure should be elevated a foot or two, to guard against dampness and flooding during cloud-bursts or from the melting of snow, and the floor should be waterproof. The sides should form practically one great window, the upper portions being constructed in such a fashion as to permit opening at the top alone in cold weather. An ample covered and partly enclosed porch should be built on the eastern or southern front, but I do not regard a solarium as very important.

The maximum number of patients to each cottage should be twenty. This permits the classification of patients as to age and type of disease, and also allows the treatment of non-tuberculous children under the same management; thus a cottage might be devoted exclusively to rhachitis, another to chronic bronchial affections, and so on, for the cottage plan is not greatly limited as to size; it is easy to group eight of these small structures around a central administration building, though the E-shaped plan is in some ways preferable.

Communication with the central building may be by covered and enclosed passageways; food may thus be more readily transported to the cottages without becoming cold, and the plan also has advantages for the attending staff in bad weather. The staff, when off duty, must be furnished with quarters in the administration

building, else lamentable institutional infections are likely to ensue. The entire institution should be heated by steam supplied from the main building, and all save minor surgical procedures should also be carried out there.

Visitors should be excluded entirely if possible, otherwise epidemics of measles and scarlatina will be of frequent occurrence. To provide for such acute infections as are bound to break out, with the best of care, a separate cottage, with a separate small kitchen, should stand quite distinct from the rest of the institution. There must be no communication by covered passages, and the attending and working staffs should be distinct. The pathological department is also to be maintained in a distinct building, preferably also without direct communication.

Ample playgrounds are a necessity; also, at the seaside, facilities for bathing. Our hot summers demand the erection of tents for sojourn during the day, so that exposure to excessive insolation may be avoided. Dense woods are objectionable because of dampness, but an open grove, especially of coniferous trees, answers very well as a substitute for tents, and allows the children more freedom. We may here state that anything like crowding or cramping of the institution or its surroundings is a grave error; a half acre to each building, as much more for outside space, and twice as much more for playgrounds, bathing beaches and the like, is none too much; thus a sanatorium with eight "effective" cottages requires a minimum space of about twenty acres, one to eight patients.

There should be no fixed limit set for the duration of

treatment, save that three months may be regarded as the minimum. Accommodations should be sufficient to allow slowly progressive cases a year or more, and the number returned home "improved" should be as small as possible, for these children regularly relapse. It is a serious mistake for an institution devoted to the treatment of tuberculosis to include "improved" cases among its successes; the lay public is already observing the frequency of recurrence in this group, and becoming skeptical as to the merits of sanatorium treatment. The German custom of returning every patient home within a definite time, usually three months, will eventually bring the entire system into discredit; a year is none too long for the cure of any well-developed tuberculous lesion.

There is much less difficulty in maintaining good institutional discipline with children than with adults; it is indeed remarkable how rapidly children become accustomed to the surroundings of a well-managed sanatorium. Home means very much less to them than their parents fondly imagine, and there is no trouble in keeping the little patients in good spirits after the first few days. Nostalgia, which leads so many adults to quit the sanatorium before much benefit has been achieved, is not an element to be weighed in the young; on the other hand, the importunities of parents for the return of their half-cured children is a serious obstacle to the highest efficiency of a sanatorium, and calls for all the tact and patience at the disposal of the management, if it is to be effectively counteracted. Laxity in this respect will assuredly impair the record and reputation of the institution; imperfect results may

confidently be reckoned among the failures, only actual and permanent cures redound to its credit among the public at large.

Thus, the problems that confront the management of a sanatorium for scrofulous and tuberculous children are manifold, and at least as much sociological as medical.

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